ILLUSTRATED
ELECTRICAL REVIEW
A Journal of Scientific and Electrical Progress.

VOL. 29. No. 3. WEEKLY. | NEW YORK, WEDNESDAY, JULY 15, 1896. | $3 PER ANNUM. Single Copies, 10 Cents.

Copyright, 1896, by Electrical Review Publishing Company, Times Building, 41 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

VIEWS, NEWS AND INTERVIEWS.

The silly season is on and it seems to possess a special intensity this year. A large number of electrical men are more than usually affected and several have developed soft spots in their craniums of really alarming proportions. One of the worst afflicted of these stopped a Review man on Broadway on one of those sweltering days last week and remarked excitedly:

"Have you heard the latest?"

"No."

"Why, a man and his wife and their son were waiting at a street corner in Brooklyn for a trolley car. Pretty soon they saw one coming. The man said 'Here he comes!' The woman said 'Here she comes!' The boy said 'Here it comes!' Now, who of the three was correct?"

"Well, who?" asked the Review man, as he took a firm grip on his umbrella.

"The man," replied the silly one.

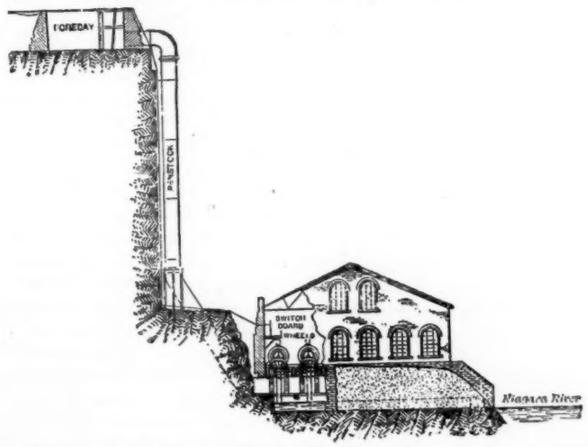
"Why?" said the Review man, as he stepped back a pace and got ready to swing his weapon.

"Because it happened to be a mail car."

The umbrella swished through the air, but the gibbering idiot saw it in time, dodged, and dashed off, cackling to himself.

The British war in South Africa has afforded another opportunity for the display of heroism by telegraphers. There was recently a hot fight between the Mashonas and a rescue party of British soldiers. Two telegraph operators, Blakeston and Routledge, were killed early in the fight while making a gallant sortie to reach the telegraph office in order to communicate the position of affairs to Fort Salisbury. Mr. Blakeston was a minister's son and was 29 years old.

Slowly but surely authors are adopting electrical situations to enhance the effectiveness of their writings. The majority make absolutely incorrect use of electrical terms, a few seem to grasp the meaning of the simpler elements of the science, while others deal with glittering generalities in order to avoid positive error. To the latter class belongs Marie Corelli. In her latest book, "The Sorrows of Satan," which is chiefly a wild diatribe against the injustice of literary critics, she relates that Prince Rimanez, who is the devil in human form, owned a wonderful and marvelous yacht called "The Flame." According to Miss Corelli this boat "was a miracle of speed, her motive power being electricity; and the electric engines with which she was fitted were so complex and remarkable as to baffle all would-be inquirers into the secret of their mechanism and potency."



Cross-Section of the Niagara Falls Hydraulic Power and Manufacturing Company's New 6,000 H.-P. Power House. Wheels Operated under 210 Feet Head.

Trolley President—How does that new fender work?

Superintendent — I never saw anything like it. They never know what strikes them.—*Life.*

A press dispatch tells about a man named Miller in Highland Falls, N. Y., who was greatly annoyed by cats in his back yard at night. Finally a happy thought struck him, and he put it into practice with startling effect. He ran a wire along his fence and connected it with the arc light circuit in front of the house. When the current was turned on the wire became charged with nearly a thousand volts of electricity. At the usual hour the cats began to arrive and started the music with a preliminary "scrap" on the front steps. An old Tom climbed nimbly on the fence. He clung affectionately to the electric wire and his howls of pain could be heard for miles. In an instant a dozen more cats were climbing up the fence trying to escape. All clung to the wire while their screams aroused the neighborhood. They were soon unconscious. Miller stole down stairs and shut off the current. "I'll bury them in the morning," said Miller to his wife. But he didn't. Every cat was gone by daylight, but they haven't returned to finish their solo.

A Long Island sheriff was in a quandary one day last week as to how to convey 50 prisoners accused of rioting from the jail to the town hall for trial. He finally chartered two trolley cars and performed his duty successfully.

Northwestern Electrical Association.

All arrangements have been completed for a very enjoyable meeting of the Northwestern Electrical Association which opens this morning in the court house at Marinette, Wis. The official train left Chicago yesterday at 3 o'clock P. M., and Milwaukee at 5 o'clock.

ELECTRICITY AND WATER POWER.

BY MARK A. REPLOGLE.

(*Continued from page 2.*)

PART II.

THE NIAGARA FALLS HYDRAULIC POWER AND MANUFACTURING COMPANY.

The great work at Niagara Falls that is being prosecuted by the Niagara Falls Power Company has attracted so much attention during the past five years, that many people think Niagara was harnessed for the first time when their great wheels began to turn.

The above great proposition will be treated later in these papers, but the present paper will be devoted to a great power that has developed so quietly that it has almost escaped public notice.

As early as 1725, Niagara power was used by the French for sawing logs. From 1800 to 1825 some four or five mills were operated at various points along the river. About the year 1850, a plan was laid to make a canal from a point about one mile above the Falls on the American side, to the high bank of the river below the Falls; and from the latter place it was intended to run the water through wheels into the chasm below. After the many reverses and discouragements, always met with by the promoters of so wild a scheme, the canal was finally finished in the year 1861.

The War of the Rebellion evidently had much to do in cooling the ardor of its leading spirits, as we find no further progress until 1870, when the first grist mill was built and operated from the canal. In 1877, the Niagara Falls Hydraulic Power and Manufacturing Company was formed, into whose hands the canal and all its belongings fell, and since that date there has been a steady increase in mills of all kinds. The canal to-day is furnishing over 10,000 horse-power of energy, and when improved to its full extent can furnish over 100,000 horse-power.

The most interesting part of this

great power is the study it has afforded to the student in hydraulics. We first find the "current wheel," followed by the "undershot" and "flutter wheel," next the early and crude forms of "turbines." Later the turbine was used under heads of 50 to 60 feet, and this was thought to be the extreme height of head to which a turbine could be subjected.

Each new proposition dipped deeper and deeper into the rocky chasm with its tail-race, until 1895, when the daring engineer now in charge, decided to use the full fall of 210 feet. There is now nearly completed a power plant worthy of more than ordinary notice. When finished it can furnish from its generators about 40,000 horse power of electrical energy. A special type of horizontal turbine is used, and each wheel is connected to two generators, one at either side of wheel, and attached to same shaft. Each wheel with its two generators furnishes about 2,000 electrical horse power, and comprises a unit of the plant's power. There will be 20 of such units when the power house is complete.

The above company has experienced a gradual development in the line of transmitting power electrically. We find first some old dynamos in a mill cellar, later a loft was built for a city lighting plant, next, a power generator was installed and electric power sold to various manufacturers. Following this was a new plant in which was installed the latest and best lighting machinery. Now comes the mammoth plant just mentioned, in which the full height of the fall is utilized. The wheels and dynamos are placed at the lower river level, and the energy will be carried on wires to the city above and distributed to the many users of this cheap and reliable power.

The Pittsburgh Reduction Company have built a large aluminum smelting plant on the bank above the power house, and will use a great quantity of the new power in supplying civilization with this new and valuable metal.

The growth of this remarkable water power has been gradual but sure. Some of the traces are still to be seen of the steps taken by this energetic company as they felt their way up to the present modern and magnificent power plant, but the Niagara Falls Power Company's plant, which is the result of all past experience, was brought before the public so suddenly and so forcibly that many failed to learn what the silent workers were doing.

(To be continued.)

Patriotism and Science.

[*From Life.*]

Little Willie's cast-iron cannon
Ne'er had felt the Roentgen ray;
Perfect was it in appearance,
But a flaw was hid away.

Little Willie's bones and muscles
All were photographed next day,
So they might collect that cannon
Aided by the Roentgen ray.

The Edison Electric Light Company of Philadelphia have removed their offices to the Heat, Light and Power Building, northeast corner of Tenth and Sansom streets.

GERMAN SOCIETY OF ELECTRICAL ENGINEERS.

FOURTH ANNUAL MEETING HELD IN BERLIN—ABSTRACT OF THE PROCEEDINGS—LI HUNG CHANG ATTENDS THE BANQUET.

For the first time since its inception, the Verband Deutcher Elektrotechniker, or Germany Society of Electrical Engineers, held its fourth annual general meeting this year in the German capital—the cradle of the society, and also of the industry, in a national sense, which it is the object of the society to protect and develop. And the meeting will undoubtedly be recorded as one of the most successful and pleasurable in the annals of the society—a result due in no small measure to the personal efforts of its able and well known secretary-general, Mr. Gisbert Kapp, as well as to the practical interest taken in the arrangements by the local Elektrotechnischer Verein.

The proceedings were formally opened on June 17 by a meeting of the Executive Committee, following in the evening by a reception of all the members and guests of the society at the Reichshallen Theater, which was attended by several men of rank, amongst them, Privy Counsellor Dr. Wehrenpfennig, representing the Ministry of Public Instruction, and Privy Counsellor von Huber, Chief of the Imperial Patent Office, besides the directors and heads of all the most important electrical works and establishments of the country. The occasion was, moreover, graced by the presence of a number of ladies, more or less directly interested in electrotechnics. Barrath Koehn, of the Union Elektricitaets-Gesellschaft, read the address of welcome, in which he personified electricity as youth, unburdened by the dust of the accumulated knowledge of centuries. Bauinspector Koss, also of the Union Elektricitaets-Gesellschaft, then introduced the Entertainment Committee, exhorting them to the prompt fulfillment of the duties to which they had pledged themselves, and concluding with a request to the chairman of the committee to "switch in" the evening's festivities whereupon the stage was brilliantly illuminated by hundreds of colored incandescent lamps, forming on either side the device "V. D. E." The entertainment following comprised several dramatic representations, all apropos of the occasion and carried out by members of the society, with musical interludes during which refreshments suited to the prevailing temperature (somewhere up in the 90's, in the shade) were served—the whole contributing to a thoroughly enjoyable and harmonious evening.

On Thursday, the 18th inst., the first business meeting was held at the Architectenhaus in the Wilhelmstrasse, the proceedings being introduced by a speech by the president, Professor Slaby, following which the Secretary-General presented his report on the status, financial and technical, and the transactions of the society during the past year, marking a steady advance in the number of members and furnishing good evidence of the usefulness of the society, both in commercial and technical fields. The reports of special committees charged with the investigation and settlement of various questions were next discussed, the most important being that on the subject of "Safety Regulations Applying to Light and Power Installations," to which the electrical press in Europe and in America have already directed attention. Another report deserving of mention dealt with the subject of "Copper Standards," the results being formulated as under:

1. Unit of resistance to be that of a column of mercury one metre long and one square millimetre cross-section, at 15 degrees centigrade.

2. Specific resistance of line copper not to exceed 0.0175, and conductivity to be not less than 57, the normal being put at 60.

3. Temperature co-efficient, 0.4% per degree centigrade.

Twelve of the leading copper works of the country have already signified their agreement with these standards.

The next item of special interest on the programme was a paper read by Mr. Rathenau, director-general of the Allgemeine Elektricitaets-Gasellschaft, on the power transmission scheme now being carried out at Rheinfelden, enbracing the utilization of the waters of the Rhine, at a point above Basle, to a total extent of 14,000 horse-power, to be distributed in the form of electric energy over a radius of about 15 miles.

A paper by Director Sarasin followed, describing in an interesting manner the electrical features of the Berlin Industrial Exhibition.

The annual dinner of the society took place the same evening at the Kaiserhof, which the Chinese special envoy, Li Hung Chang, now in Berlin, honored with his presence.

Friday morning was devoted to a visit to the famous Physikalisch-technische Reichsanstalt, at Charlottenburg, and to an inspection of the extensive establishments of Messrs. Mix & Genest, Limited, manufacturers of telephone and telegraph apparatus, and the Allgemeine Elektricitaets-Gesellschaft, where Mr. von Dolivo-Dobrowolsky, chief electrician, showed the party a dynamo which he had constructed, having a difference of potential at the terminals of 24,000 volts. It was a three-phase machine, with stationary armature and revolving field, of about 25-kilowatt capacity, although it looked much larger, owing to the special insulation. The machine was not running at the time.

On Friday, the last society day, the second business meeting was held, at which the officers for the ensuing year were elected, and other decisions taken. This was followed by the reading of several papers, all of which were interesting, although not specially noteworthy. H. Q.

Berlin, Germany, June 22.

Mr. C. P. Price has returned to Boston and his managerial duties at Pettingell-Andrews Company after a tour of the Adirondacks.

LITERARY.

The *Tammany Times*, of New York city, has published a souvenir number for the Chicago Convention, which surpasses, in point of size and beauty, all of its previous special editions. It is a 44-page number, its cover pages are in colors, with green and gold predominating, and the title page is a work of art.

We have received a reprint of a paper entitled "Experimental Determination of the Motion of Projectiles Inside the Bore of a Gun with the Polarizing Photochronograph," by Dr. Albert Cushing Crehore and Dr. George Owen Squier. The paper originally appeared in the *Journal of the United States Artillery*.

"Something About X Rays For Everybody," by Edward Trevert, is the title of a little paper-bound book which contains considerable original matter relating to the construction of X-ray apparatus. Besides there is a general compilation of X-ray matter taken from the technical journals during the past three months. The price of the book is 25 cents, and it will be sent postage free on receipt of price by the ELECTRICAL REVIEW, Times Building, New York.

The D. Van Nostrand Company, New York, will have ready in August a new and timely work entitled "Roentgen Rays: The Phenomena of Anode and Cathode," by E. P. Thompson. The work also contains a chapter on arguments and theories relating to kindred radiations and phenomena by Prof. William A. Anthony. The book will be illustrated with 50 diagrams and 30 half-tone reproductions of radiographs. The price will be $1.50. It will be supplied postage free on receipt of price by the ELECTRICAL REVIEW, Times Building, New York.

The electrical field has produced a new novelist in the person of Mr. E. H. Heinrichs, of the Westinghouse Electric and Manufacturing Company, Pittsburgh. Mr. Heinrichs has for several years contributed short stories to the press and now enters the field with a novel under the title "Helene," which has been favorably criticized by the Pittsburgh papers. The story deals with the times of 1848 in Germany when the questions of caste between the aristocracy and common people were so marked. Mr. Heinrichs is evidently thoroughly in sympathy with his subject and has interwoven his arguments with a tale of tragedy and love.

Electric Transmission to Montreal.

The contract for the entire development of 20,000 horse-power on the Richelieu River, the outlet of Lake Champlain, has been let for $550,000, the electric machinery not being included. This power is to be carried to Montreal, the distance being about 12 miles. This is the second electric water-power development furnishing current to Montreal, the first being for 12,000 horse-power at the Lachine Rapids, five miles above the city in the St. Lawrence River. The investment in both powers will be about $3,500,000, all subscribed for by Montreal capitalists.

The American Pivotal Truck.

The J. G. Brill Company, the well known car builders of Philadelphia, are placing upon the market a new passenger car truck for which they claim several novel features and advantages. They call it the American passenger pivotal truck and it is built on the theory that it is an independent carriage. Its wheels are independent of each other in their vertical motion while the truck frame itself can rise and fall at the ends or move sideways bo lily without imparting any of this motion to the body of the car.

In the accompanying illustrations, Fig. 1 shows a perspective view of the truck. The side elevation is given in Fig. 2. Fig. 3 is a comparison of the new style and old style swing motion. The construction of the spring link used on this truck is shown in Fig. 4.

The American pivotal truck is built with a wrought-iron frame having jaws forged on with solid extension pieces, T-iron end pieces, angle iron jaw-straps and angle iron transoms. The equalizers are a part of the spring plank. They carry the swing bolster and take their load in the center. They are in turn carried by links and move with the swing motion. Eight-inch journal-box springs, nest spirals in the links, and quadruplet or triplet elliptics on the equalizer and spring plank furnish the vertical elasticity.

It is claimed that the strains upon the truck frame for the given weight of car and load are much less than in the ordinary construction. Referring to Fig. 3, the old style of swing motion is shown on the right and that of the American truck on the left. In both cases the center plate is taken as the center of motion and support—the circles representing the lines of motion. With the old style of link the radius of motion is that of the inner circle. The radius of the outer circle is obtained by placing the hangers outside the wheels as shown. The motion, of course, will be slower in proportion to the greater radius, and correspondingly easier.

The makers claim the following important and numerous advantages for the American truck.

Side thrust is absorbed by greater transverse spring base.

Additional cushioning of the load in the spring links.

Springs directly over the journal boxes, reducing noise, jar and pounding of the joints.

Reducing on the axles the amount of weight which is unsupported by springs.

No uncushioned load upon the journals.

Less lifting action when the brake is set, consequently less noise and jar in stopping.

Perfect equalization of the load on wheels, owing to springs of a draw and recoil character in the swing links, and because of the superior action of the equalizer.

Cushioning of the side motion by the swing link springs.

Reducing lift of car body when the wheel rises.

Wheel piece, pedestal, wheel piece extension, solidly forged in one piece, which gives manifest economy of maintenance.

Straight low end pieces of truck frame clearing draught timbers and increasing strength.

Ability to shorten wheel base with same space for motors on electric cars.

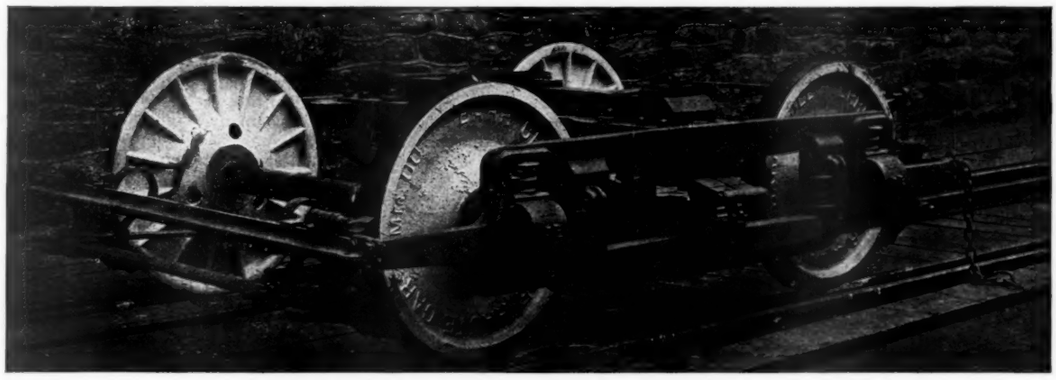


FIG. 1.—THE AMERICAN PASSENGER PIVOTAL TRUCK.

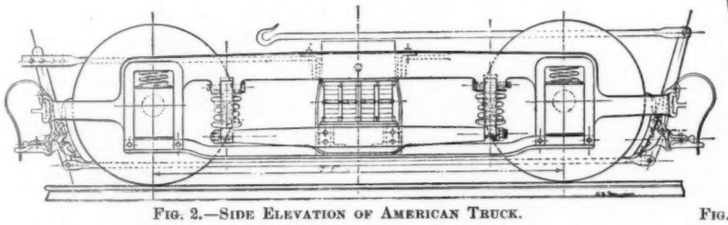


FIG. 2.—SIDE ELEVATION OF AMERICAN TRUCK.

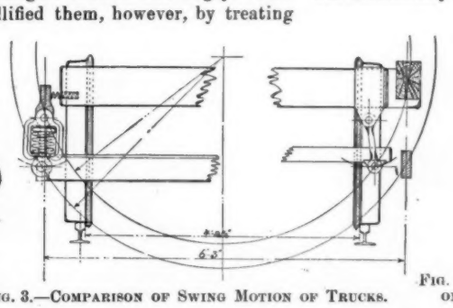


FIG. 3.—COMPARISON OF SWING MOTION OF TRUCKS.

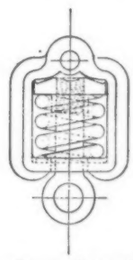


FIG. 4.—SPRING LINK USED ON AMERICAN TRUCK.

Death of George Law.

Mr. George Law, president of the Eighth and Ninth avenue street railroads of New York city, died on July 7, of the immediate effects of erysipelas. Mr. Law was well known among street railway men and was a famous club man and bon vivant. He was famous as a backer of pugilists and was well known for his many eccentricities of character. His father at one time owned the Staten Island ferries and later became interested in the street railroads of which Mr. George Law was afterwards president.

Among the many anecdotes told of Mr. Law is one to the effect that his father, who was a strict disciplinarian, made his son drive a car twice a day from Fifty-ninth street to the Astor House so he might learn the business from the bottom up. Young Law was driving up Eighth avenue late one cold, drizzling night, when a young friend jumped on the front platform and invited the future railroad president to have a drink. He proposed that the car should meanwhile be left in charge of the conductor.

Law, after he had carefully digested the proposition, said he thought he knew a better plan, and, whipping up his horses, he switched his car into Fifty-fifth street and drove over the cobblestones to a resort in the middle of the block kept by a former boxing instructor in Columbia College. The car drew up at the door of the saloon with all its windows broken and all its passengers bruised and angry. Law mollified them, however, by treating all hands. The horses were then changed to the other end of the car and the car restored to its proper position in Eighth avenue.

Westinghouse Generators for the Niagara Falls-Buffalo Transmission.

It is announced that the Niagara Falls Power Company has ordered from the Westinghouse Electric and Manufacturing Company, of Pittsburgh, seven dynamos to be used exclusively for the Buffalo transmission. These machines will have a capacity of 5,000 horse-power each. Contracts have also been given for a power house and wheel pit for the dynamos. The officers are reported as saying that before Summer closes Niagara power will be furnished to Buffalo.

SIR JOHN PENDER DEAD.

ONE OF THE CHIEF PROMOTERS OF OCEAN TELEGRAPHY SUCCUMBS TO PARALYSIS.

Sir John Pender, well known in connection with the development of ocean cables, died in London on July 7 from the effects of a second stroke of paralysis. In January last he had a similar attack which compelled him to resign his seat in Parliament.

He was well known as an authority on ocean telegraphs, with which he has been connected for many years. He was originally a merchant. When the project of laying the first Atlantic cable was broached by Cyrus W. Field, he was one of a large number of persons who subscribed $5,000, in order that the experiment might be tried. Afterwards when the first cable had been lost and the project seemed doomed to failure, Sir John Pender revived the scheme by offering his personal guarantee to the extent of $1,500,000. Eventually the cable was successfully laid and the old one was found. Afterwards Sir John became the head of the telegraph cable companies operating outside of the Atlantic; in fact, virtually filled the position of chief of the British submarine telegraphy.

He was a Scotchman, was born in 1-16, and was educated in the Glasgow high school. He was a member of many scientific societies and had held numerous political offices. From 1872 to 1885 he represented the Wick Burghs in Parliament and again sat for the same constituency from 1892 to 1895.

It is now possible, by the connections which the Newton, Mass., Street Railway Company has, to make the entire trip from Waltham and Newton to Nantasket Beach by electric lines for a fare of 45 cents. This trip has of late become very popular.

ELECTRICITY SUPPLY AT TWO HUNDRED AND TWENTY VOLTS.

BY A. S. BARNARD, BEFORE THE MUNICIPAL ELECTRICAL ASSOCIATION, ENGLAND, JUNE 10, 1896.

(Concluded from page 23.)

The next point is, How will the higher pressure affect the wiring and fittings on consumers' premises? As far as present experience goes, there is nothing to fear on the score of increased fire risk. Installations designed for 100 or 110 volts pressure when changed over to 220 volts run very little, if any, extra risk. The current in the wires is reduced to about one-half of what it was, and this quite balances the objection to the pressure being doubled. As a rule, it is not the insulation of the wires that is at fault in an old installation so much as the badly made joints and overloaded wires. A badly soldered joint is far less likely to cause trouble under the new conditions, as the heating would be less and the loss of voltage at the joint would be proportionately to the voltage of the lamps less also. Many of the flimsy little switches, cut-outs, and ceiling roses, too, where the insulation is fairly good, are really *safer* with 220 volts and the reduced current than they were with 110 volts. Certain little American switches which are largely in use at Hull, and which get perceptibly warm with a 32 candle-power, 110-volt lamp, will keep quite cool, and work with less sparking, with a 220-volt lamp of the same candle-power. In most of these little auxiliary appliances the electro motive force has been amply provided for—but the carrying capacity of the screws, terminals, contact-plates, etc., is sadly overestimated.

In the matter of fuses, given a sufficient length of break, a fuse appears to act more suddenly and certainly at 220 volts than at 110. Single-pole fuses are certainly to be preferred to double-pole, for these latter are seldom constructed with the poles sufficiently separated to be safe from arcing when the fuses melt; also, the moisture which often condenses on a porcelain base is more likely to cause serious leakage, and perhaps arcing, with 220 volts than with 110. In wiring new premises for any considerable number of lamps at the higher voltage, a slight saving may be made in the cost of wires. Even allowing a rather better class of insulation, yet by reducing the main cables to about half the size they would otherwise be, some reduction is made in the expense. This will not apply in the case of small branch wires, and the wiring of shops, etc., for two or three lights, for in these cases it is not the current density so much as the mechanical strength of the wire that determines its size. For instance, a solid wire would not be used smaller than No. 18 S. W. G. to supply an eight candle-power lamp, though at 220 volts this only represents a current density of about 100 amperes to the square inch. The fire offices may not altogether agree with this view, but it should be evident to all that in ordinary house-wiring the danger of fire lies more in excessive currents than excessive pressure, and doubling the pressure at the lamps will certainly mean a reduced current density in the smaller wires. It is the writer's opinion that, with attention to the details of fittings, such as fuses, switches, and ceiling roses, wiring at 220 volts will be just as cheap and rather safer than at half that pressure.

With regard to the use of arc lamps in shops, etc., some great objections can be urged against the use of 220 volts. The consumer *will* ask to be able to switch off separate lamps, and to use one or two lamps without paying for the current for four. Even now, at 110 volts, there is often trouble through a man who has one lamp only, finding that his current costs him as much as his neighbor pays for two. Until some means can be devised for reducing the pressure to, say, 50 volts without wasting energy in resistances, this will remain a difficulty, though, perhaps, something may be done by arranging a number of small arcs to burn in series in one globe. Still, this would be a troublesome and expensive arrangement, and the effect would not be the same as with one large arc. Of course, in street lighting from the low-pressure mains, the higher pressure would be a great advantage, as it would enable as many as eight or nine lamps to be run in series across the outer wires and to be controlled by one switch, thereby reducing the labor of switching the lamps on and off. With electric motors there need not be any trouble, as these can be wound to work at 220 volts just as well as at 110, and certainly the reduced current taken by large motors will reduce the cost of the starting resistances, etc., and will also lessen the effect on the lamps in the neighborhood when the motors are started or stopped.

Now as to the incandescent lamps that are as yet on the market for use at this pressure. In the first place, of course, where lamps are always used in groups of two or four, the ordinary lamps for 110 volts can be used coupled in series. Some makers have even brought out a little fitting for adapting the ordinary lamp holder to take two lamps like this, the idea being that, where a 16-candle-power lamp was in use, two 8-candle-power lamps should be fitted, and so on. This is very neat, and gets over many of the objections to 220-volt lamps, but it is hardly adapted for universal use, as the two lamps will not go into many of the glass shades, etc., in use, and many people will consider that their appearance is not nearly so æsthetic as that of the single bulb. Other makers have put the two filaments into one bulb, and coupled them together either inside the bulb or just outside the neck in the plaster cap. Several firms have, however, boldly grappled with the question, and have succeeded in making single-filament lamps having bulbs little or no larger than those commonly in use, and these seem to indicate the lamp that will shortly become commonly adopted.

As might naturally be expected, the lamps with single filaments have hardly reached the stage of durability and efficiency that the double-filament lamps have attained. For all that, most excellent results have been obtained from some individual lamps of this type, and equally poor results with samples of double-filament lamps. On this question Mr. Gibbings, the borough electrical engineer of Bradford—where double-filament lamps are mostly in use—writes as follows: "The 230-volt lamps are very much appreciated by our consumers; in fact, we are continually being pressed by those we have not changed over to do so, and we find that the life of these lamps comes out, if anything, better than the ordinary 115-volt lamps." Such favorable and positive testimony as this is rather surprising, but the secret is to be found in the steadier and more even pressure supplied, rather than in the better quality of the lamps. In either case it is most satisfactory and encouraging, and should help to convince any who doubt the possibility of a commercially good 220-volt lamp being made that, at any rate, it is quite possible to equal the 110-volt lamp.

In the lamps under the writer's own observation, the average life is quite equal to that of the best makes of 110-volt lamps. With the exception of one maker's samples, the candle-power has been maintained longer, and there has been less blackening of the glass. Several lamps fail through short-circuits occurring in the cap, but this fault also is absent from the lamps of several makers. Other lamps have failed through the long filament touching the glass whilst hot, and so cracking it and admitting air; and especially has this been the case when these lamps have been run in any position other than vertical.

Of course, in a paper of this sort, it would not be right to recommend any firm's lamps as superior to others. All the makers are now working towards the elimination of these defects, and several have already successfully got over the difficulties, as may be judged from the accompanying illustrations.

In conclusion, the writer would express the belief that the 220-volt lamp will soon be recognized as the most useful advance that has been made in electric lighting in the past year or two. It is on the market now, is being fairly tested and found satisfactory in several towns, and it has "come to stay."

Electric Lighting of Railway Trains in Australia.

The electric lighting of the Broken Hill (South Australia) express train is carried out by means of a charging dynamo and storage cells fitted up in the brake van and incandescent lamps of five and ten candle-power fitted in the second-class and first-class carriages, respectively.

The charging dynamo is driven from one of the brake-van axles by means of a linked leather belt running over two flanged jockey pulleys sliding on two vertical standards above the dynamo pulley. The belt is kept tight by strong spiral springs placed under the brackets carrying the jockey pulleys. The tension of these springs is regulated by screws, so arranged that the jockey pulleys can be lowered sufficiently to stop the revolution of the dynamo by slackening the belt on the van axle pulley, this pulley being provided with deep flanges to keep the belt in position when so slackened. The output of current from the dynamo is regulated by a centrifugal governor, belted to the dynamo spindle. When the train attains a speed of 25 miles per hour, the movement of this governor automatically couples the dynamo to the cells and the lighting circuit, and also keeps the output of the machine constant with any variation of speed above that rate. Should the speed drop below 25 miles per hour, the circuit is broken again by the governor. The machine is capable of an output of 80 amperes at 65 volts.

The storage battery consists of 24 cells, each having a capacity of 550 ampere hours, distributed about the brake van so as to equalize the weight on the bogies. The charging rate of these cells is 55 amperes, and the dynamo is so arranged as to charge the cells at the maximum rate at the same time as it is lighting the lamps in the train. Suitable automatic appliances are placed in the brake van to keep the brilliancy of the lamps at the normal point, whether run off the cells or the charging machine, together with indicators showing the amount of current taken by the lamps when burning.

The method of running the plant is as follows: When it is necessary to charge the cells, a special attendant is sent out with the train for the round trip from Adelaide to Terowie, a distance of 280 miles, during which he charges the cells to their full capacity. The lighting of the train on the following one or two trips—depending upon the size of the trains and the season of the year—is performed by the storage cells, the coupling of the leads between the vehicles and the switching on and off of the lights being carried out by the guard in charge of the train, who also takes frequent records of the amount of current used on the journey. As soon as the amount of current used on these non-charging trips approaches the quantity that can be stored by a round-charging trip, the special attendant is sent out with the train and the cells recharged to their full capacity again. The charging machine is never run unless the special attendant travels with the train, the machine being thrown out of gear by the slackening of the belt. On an average, it is necessary to charge the cells every second trip in Winter and every third trip in Summer.

Each first-class compartment is fitted with two 10 candle-power lamps, each second-class compartment with two five candle-power lamps, and the brake van with three 10-candle-power lamps. Two lamps are placed in each compartment, so that the light shall be maintained in the event of the extinction of a lamp. The floor space of each compartment equals about 52 square feet. The number of vehicles on the trains varies from six bogie carriages and brake van, representing twenty-five 10-candle-power and thirty-four 5-candle-power lamps, to four bogie carriages and brake van, with nineteen 10-candle power and twenty-eight 5-candle-power lamps.

The cost of installing the electric light in this train—consisting of five composite carriages of six compartments each, one lavatory carriage of four compartments and one brake van—was £790 ($3,844.53).

The cost of maintenance, renewals and repairs of the electric light per week, under the present running conditions, is as follows: Wages of attendant, supervision, etc., £2 7*s.* 3*d.* ($11.49); maintenance and renewals of storage cells, machinery and appliances, lamp renewals, oil, waste, etc., £1 6*s.* 6*d.* ($6.44); average cost per week, £3 13*s.* 9*d.* ($17.93). The cost of lighting the train previously with kerosene was £4 ($19.46) per week.

The number of failures of the light during the two years it has been running has been practically *nil*, and over part of the journey only on two occasions has the light not been available. On one occasion this was due to wet weather and some slight imperfection of the couplings to the leads.

When the machinery was handed over to the department, there was no means of stopping the dynamo while the train was running. An alteration looked upon as that which insured the success of the installation was the method of dropping the belting from the pulley as described.

DANIEL W. MARATTA,
Consul-General.

The Doty-MacKnight Automatic Track Switch for Electric Railways.

"It is as simple as touching a button, or turning on an electric light."

That is what the inventors of a new automatic electric track switch for surface railroads say of their device, and what a number of railroad men and others saw, for themselves, in New York city on Wednesday of last week.

A private exhibition of the Doty-MacKnight switch was held on that day at the office of the inventors, 54 Stone street. The machine was set up in connection with a switch-tongue and operated by current as in actual practice.

The machine impressed the observer by its obvious simplicity, its effectiveness for its intended use and the wonderful compactness of its construction. It seemed, in fact, to have overcome many objections that can be raised against such a contrivance, and was claimed to possess every requisite of complete success.

The accompanying illustrations give a good idea of the switch, but are lacking in many details.

The machine consists of a pair of large solenoid magnets fitted in iron jackets. The cores of these weigh about 28 pounds each. They work perpendicularly, like a piston, the effective stroke being upward. The dead weight lift of each solenoid is about 70 pounds, with a current of 15 amperes. As the core is raised, an insulated point above the cover of the solenoid jacket pushes up a bell-crank lever which acts on the switch tongue, throwing it to one side. It strikes a blow like a sledge-hammer.

The horizontal pipe between the solenoids contains the reversing device, which is shown in one of the cuts. This ingenious mechanism is so arranged that it acts as an automatic cut-off, and turns the current from the solenoid last used so that the other will be actuated the next time the current is applied.

By this means mistakes in turning the switch are rendered out of the question. If a motorman approaches a switch and sees that it is right for him, he goes on his way rejoicing; if not, he applies the current, and the tongue is instantly thrown into the position he desires.

The current is applied by the motorman's controller in the same manner as for propelling his car. Near the switch, a short section of track, one rail length, is cut out of the circuit and carefully insulated. This insulated section is connected by a lead-covered copper wire to the current reverser, and through it to the solenoids. The solenoids are contained in a small iron box under the switch tongue, and at right angles with the track. The actual excavation required is two feet by four feet and four feet deep.

The bell-crank levers are detached from the switch tongue, as shown in the cuts, a plan which saves the machine from the jarring which might arise from a rigid connection with the track. It has the additional advantage of leaving the tongue entirely free for purposes of cleaning, etc.

In the construction of the solenoids great care has been taken to insulate the parts and to protect them from damp and moisture. The inventors say there is nothing about the machine that can wear out in 10 years of ordinary usage. In practice it is the intention to make a sewer connection with each switch, in order to give longer life and efficiency to the machine. But, as a matter of fact, the apparatus will work perfectly, if the box is filled nearly full of water, mud and rubbish, and frozen solid.

The whole machine is effectively insulated from the frame in which it hangs, and at every point of contact, so that it is practically impossible for the current to become grounded or short circuited from any cause whatever.

The solenoids are built to carry for the short time necessary, a maximum of 25 amperes, but the contact is so short (in no case more than a second or two) that it would not matter if 30 or even more amperes passed through the coils of the solenoids. They will throw the heaviest switch with less than 10 amperes.

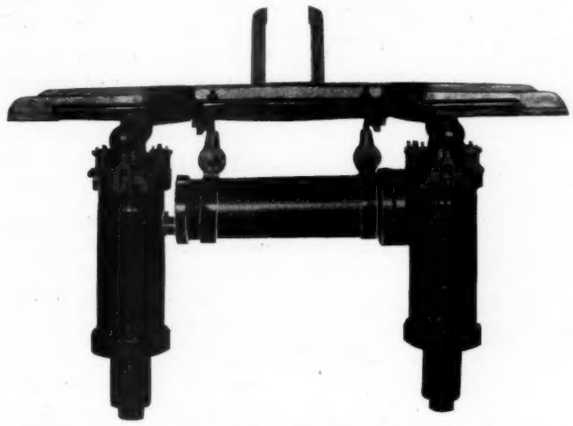


FIG. 1.—GENERAL VIEW OF DOTY-MACKNIGHT AUTOMATIC ELECTRIC RAILWAY TRACK SWITCH.

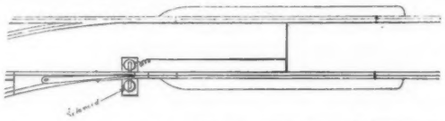


FIG. 2.—PLAN VIEW OF TRACK WITH DOTY-MACKNIGHT SWITCH IN PLACE.

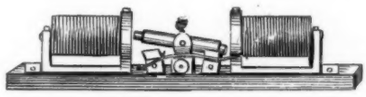


FIG. 3.—REVERSING DEVICE FOR DOTY-MACKNIGHT SWITCH.

FIG. 4.—SOLENOID OF DOTY-MACKNIGHT SWITCH AT REST.

FIG. 5.—SOLENOID OF DOTY-MACKNIGHT SWITCH RAISED IN ACTION.

FIG. 6.—RIGHT SOLENOID OF DOTY-MACKNIGHT SWITCH PUSHING BELL CRANK LEVER.

International Congress of Electricians at Geneva.

Under the auspices of the Swiss Society of Electrical Engineers an international electrical congress will be held at Geneva, Switzerland, from August 4 to August 9. M. Turrettini will preside. This congress has been indorsed by the American Institute of Electrical Engineers as well as by a large number of foreign electrical societies.

Those who propose to read papers are requested to forward the manuscript before July 20, and those who propose to take any part whatever in the congress had sent their names in before July 1. The following subjects have been selected for discussion at the congress: Magnetic Units, Photometric Units, Transmission and Distribution of Power to Great Distances by means of (1) Direct Currents, (2) Alternate Currents, Protection of High-Pressure Overhead Electric Lines against Atmospheric Discharges, Various Disturbances caused by Electric Traction.

The price of a ticket for the congress, which includes everything set down in the programme (except excursions), and in addition all publications relating to the proceedings, has been fixed at 20 francs. The price of a ticket for ladies accompanied by a member of the congress is 15 francs.

Intending participants are requested to secure lodgings beforehand by applying directly, and, if possible, before August 1, to the Bureau officielle des Logements de l'Exposition, and to mention in their request that they are members of the congress. All communications with regard to papers, etc., should be addressed to the Bureau du Congrès International des Electriciens, Université, Genève.

Another Street Railway Infringement Suit.

A bill in equity was filed in the United States Circuit Court at Boston, on July 6, by the Thomson-Houston Electric Company against the Gloucester, Essex & Beverly Street Railway Company, claiming that the defendant was infringing patents granted to Norman G. Bassett for electric railway motors.

ELECTRICAL REVIEW

Times Building, 41 Park Row,
P. O. Box 2339. NEW YORK.

EDITOR:
CHARLES W. PRICE.

ASSOCIATE EDITOR:
STEPHEN L. COLES.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.

1546 "CORTLANDT," TELEPHONE CALL.

SUBSCRIPTION TO THE
ELECTRICAL REVIEW.

One Year, United States and Canada, - $3.00
One Year, Foreign Countries, - - 5.00
Single Copy, - - - - - - - .10

Copies can only be supplied for one year back at 25 cents each.

SPECIAL NOTICE TO ADVERTISERS.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue.

NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

NEW YORK, JULY 15, 1896.

CONTENTS.

	PAGE.
Views, News and Interviews	25
Northwestern Electrical Association	25
Electricity and Water Power	25
Patriotism and Science	26
German Society of Electrical Engineers	26
Literary	26
Electric Transmission to Montreal	26
The American Pivotal Truck	27
Death of George Law	27
Westinghouse Generator for the Niagara Falls-Buffalo Transmission	27
Sir John Pender Dead	27
Electricity Supply at Two Hundred and Twenty Volts	28
Electric Lighting of Railway Trains in Australia	28
The Doty-MacKnight Automatic Track Switch for Electric Railways	29
International Congress of Electricians at Geneva	29
Another Street Railway Infringement Suit	29
The Municipal Electrical Association	30
Electric and Steam Railways on Long Island	30
The Financial Side	31
Thayer & Company, Incorporated	31
Western Telephone Construction Company Not in Any Combination	31
High-Power Projectors	31
S. K. C. Specialty Company	31
Personal	31
Telephone Facilities at the Chicago Convention	31
The Telephone in Railroad Practice	32
A Home-Made Electric Ventilating System	33
Inexpensive X-Ray Apparatus	33
Soldering Glass	33
On the Invisible Radiations Emitted by Phosphorescent Bodies	33
Willyoung Induction Coils with Adjustable Condensers	33
The Electric Light in Mining Operations	34
Kamm's Zerograph	34
Telephone News and Comment	35
A British Estimate of Lord Kelvin	35
Advance Information	36
Kindred Interests	ix
A New Line of Engines	ix
Electrical Patents	x

INDEX OF ADVERTISERS.

COVER PAGES.

	PAGE
Abendroth & Root Mfg. Co., boilers	xvi
American Electrical Works, insulated wire	i
Armington & Sims, engines	xvi
Babcock & Wilcox Co, boilers	xvi
Beacon Lamp Co., incandescent lamps	i
Bristol Co., recording voltmeters, etc	i
Bunnell & Co., J. H., dry batteries	i
Day's Kerite, insulated wire	i, viii
Electric Appliance Co., supplies	i
Goubert Manufacturing Co., heaters	xvi
Greeley, The E. S., & Co., electrical supplies	i
Hampson, E. P., & Co., engines	xvi
Interior Conduit and Insulation Co., Lundell dynamos and motors	i
Lombard Water Wheel Governor Co	xvi
McKenney & Waterbury, lamps and fixtures	i
Morris, Tasker & Co., tubes, poles, etc	iii
National India Rubber Co	i
New York Insulated Wire Co., Grimshaw wires and cables	i
Okonite Co., insulated wire	i, xvi
Partridge Carbon Co., motor and generator brushes	i
Roebling's, John A., Sons Co., lead-encased cables	xvi
Safety Insulated Wire and Cable Co	i
Standard Paint Co., insulating compound	i
Stanley Electric & Mfg. Co	ii
Stirling Co., water tube boilers	xvi

INSIDE PAGES.

	PAGE
Addystone Pipe and Steel Co	vi
American Bell Telephone Co	xiii
American Electric Telephone Co., long-distance telephones	xiii
American Engine Co., American-Ball engines	iv
Aylsworth & Jackson	ix
Baechtold & Parker Electric Co., American arc dynamos	ix
Baker & Co., platinum	x
Ball & Wood Co., engines	iv
Baltimore & Ohio R. R. Co	x
Baxter, H. E., & Co., electrical supplies	ix
Brady, T. H., Brady mast-arms	vi
Brill, J. G., Co., railway cars	viii
Brixey, W. R., Day's kerite wires and cables	viii
Brush Electric Co., electric lighting and power apparatus	viii
Buckeye Electric Co	iv
Central Electric Co., fans	iii
Central Islip Improvement Co	ix
Chase & Vale, patent attorneys	x
Coles, W. S	x
Connecticut Pipe Mfg. Co	xi
Connecticut Telephone and Electric Co	xii
Consolidated Telegraph and News Co	x
Correspondence School of Technology	x
Cutter Electric and Mfg Co	ix
Dayton Globe Iron Works Co., new American Turbine	xi
Diehl Mfg. Co., fans	iii
Dixon, Jos., Crucible Co., belt dressing	v
Duval, E. S., Jr., patents	x
Dyer & Driscoll, patent solicitors	x
Edison Electric Light Co	x
Edison Mfg. Co	iii
Electric Storage Battery Co	iii
Empire China Works, porcelain specialties	x
Eppenger & Russell Co., Valentine subway electrical conduit	vi
Faraday Carbon Co., carbons	iv
Farr Telephone Construction & Supply Co	xiii
Forest City Electric Co	v
"For Sale"	ix, x
Fort Wayne Electric Corporation	x
Garvin Machine Co	v
Gordon-Burnham Battery Co	v
Hano, Philip, & Co	xii
Hoopes & Townsend	vi
Hooven, Owens & Rentschler Co., electric railway and electric light engines	iii
Huebel & Manger, bells, push buttons, etc	ix
India Rubber and Gutta Percha Insulating Co	viii
International Correspondence Schools	ix
Jewell Belting Co	v
Keystone Telephone Co	xiii
Leffel, Jas., & Co	vi
Lehigh Valley Creosoting Co., creosoted lumber	vi
Manhattan Electrical Supply Co	xii
Marshall, Wm., condensers	ix
Mason-Maxwell Telephone Mfg. Co	xiii
McIntire, C., Co., The, connectors and terminals	ix
Metropolitan Electric Co	vi
Mianus Electric Co., telephones and electric supplies	xiii
Moore, Alfred F., insulated electric wire	x
Morrison Southern Electric Co	xiv
National Pipe Bending Co	iv
New England Engineering Co	xi
Novelty Electric Co., supplies	v
Ostrander, W. B., & Co., supplies	vi
Pemsel, F	xii
Pettingell-Andrews Co	v
Phillips Insulated Wire Co., wire	viii
Replogle Governor Works	xi
Rodrigues, M. R	v
Rose Polytechnic Institute	x
Royce & Marean, electrical supplies	xi
Rushmore Dynamo Works	x
Safety Car Heating and Lighting Co	vi
Standard Underground Cable Co	x
Telephone Construction Co	xiii
U. S. Mineral Wool Co., copper caskets	x
Viaduct Mfg. Co., telephones, etc	xiii
Warren, A. K., & Co	x
Washington Patent Agency	x
Western Electric Co., fans	xiv
Western Telephone Construction Co	vii
Westinghouse Electric & Mfg. Co	xiv
Weston Electrical Instrument Co., measuring instruments	viii
White-Crosby Co., contracting engineers	ix
Whitney Electrical Instrument Co	ix

The London *Statist* says that electric traction is making considerable progress in England. Experiments with electric power are being conducted by the two London underground roads, and the new Central London Railway will also be equipped. Its adoption on a general scale is thought quite likely. Will London beat New York in this race?

THE MUNICIPAL ELECTRICAL ASSOCIATION.

The chief topic of interest in British electrical circles is the first annual convention of the Municipal Electrical Association recently held at the Royal United Service Institute, Whitehall. The association was formed to promote the interests of municipal electrical undertakings, and its members consist of borough engineers and representatives of electric lighting committees. The convention was very successful, the papers and discussions being interesting. A number of stations in the vicinity were inspected and the social side of the meeting was not neglected. In 1897 the association will meet in Manchester. Our British cousins are rapidly appreciating the benefits of organization and we expect that before very long there will be an association formed by the electric railway people of Great Britain.

The daily press of New York city recently devoted columns to a description of a Frenchman's alleged discovery of a process for photographing thought. One of the New York papers saw fit to interview Mr. Edison and Mr. Tesla on the subject. Mr. Edison's comment was "humbug and charlatanism," and he said that the matter was not worth talking about. Mr. Tesla said that it was quite beyond any possibility that thought should be photographed, and added, "thought is beyond the reach of photographic apparatus." How much better it would have been to have interviewed even one scientific man before the matter was put in cold type.

Electrical men seem to be taking a more than ordinary interest in the present political contest, which promises to be especially exciting. Among the Eastern electrical people there are a number of men well informed on the all-absorbing topic of the currency question. The feature of comment last week, aside from the Chicago Convention, was the bolt of the New York *Sun* and its unqualified announcement that it would support William McKinley as against any free-silver Democrat.

The recent hot days have added considerably to the revenues of electrical men. Central stations have been supplying an unusual amount of current for fan motors, and the sale of electric fans has increased. All the electric railways carrying passengers to seaside, lake and other pleasure resorts have been compelled to handle a heavy traffic.

ELECTRIC AND STEAM RAILWAYS ON LONG ISLAND.

The residents of the more populous sections of Long Island and the hundreds of thousands of non-residents who frequently visit the many pleasure resorts on Long Island should contemplate with satisfaction the rapid extension of electric railways in that territory and especially the building of those lines which come into direct competition with the Long Island Railroad. The steam railway business of the island is controlled by this grasping corporation. The train schedules seem to be devised more for the convenience of the railroad people than to serve the absolute needs of the public who are compelled by force of circumstances to travel in its cars.

Unlike other steam railroads having direct connection with the city of New York, the Long Island Railroad does not provide passage on its ferries without extra expense. In both going and coming from New York city to the terminus of the Long Island Railroad in Long Island City, a ferry charge of three cents for each passenger is exacted in addition to the railroad fare. The locomotives used on the road are supplied with soft coal and the smoke they belch forth often fills the passenger cars when the widows are opened in the Summer time. This fact, coupled with the ill-smelling odors of Newtown Creek, affords one of the real delights of traveling on this road.

There is now building an extension of electric railway lines which will bring towns as far away as Hempstead in direct communication with the Brooklyn Bridge. The fare on the Long Island Railroad from Hempstead to Long Island City is now somewhere in the neighborhood of 50 cents. It is expected that the fare on the trolley cars will be 10 cents. Patronage has flocked to the trolley cars running direct from the Brooklyn Bridge to Coney Island to such an extent as to make traveling on them almost dangerous. With good management this trouble should be remedied. This only goes to show how glad the traveling public is to ride in any other way than on the cars of the Long Island Railroad Company. Judging from personal experiences, it costs about one cent a minute to travel on the Long Island Railroad. Electric railways should have no trouble in competing against such an exorbitant rate of fare. It is almost too much to hope that the Long Island Railroad management will ever adopt electricity as a motive power, unless they are absolutely forced to do it by the cutting down of their passenger business.

THE FINANCIAL SIDE.

There was practically nothing in the stock market this week, owing to events of absorbing interest that transpired at Chicago. There can be but one opinion regarding these in all rational quarters, viz., that they were revolutionary and that they will be repudiated by the people in November in a way that will practically kill the free-silver craze. The platform, favoring free silver, the repudiation of debts, the abolition of the Supreme Court in its present form, etc., had practically no effect upon stocks. This would be surprising were it not well understood that the five point decline, following the nomination of McKinley, was in discount of what occurred this week. Prices refused to go any lower for the reason that no one owning securities has any faith in the strength of the Democratic ticket or position. This stolidity, in view of the determined bear aggression, heralded an early rally in prices upon the publication of McKinley's letter of acceptance. Convention events affected the business world more than they did Wall street. They intensified the waiting policy and will probably render the situation uncertain until the campaign is well under way. This will not prove as serious to business, coming in mid-Summer when curtailment is natural, as would have been the case later in the season.

The gold reserve is below the arbitrary mark of $100,000,000, and there is considerable talk in speculative circles of gold hoarding. Only faint signs have been detected up to this time. The silverites are an inconsistent lot, and inasmuch as they are the only element that expects silver victory it would not be surprising if they make an attempt to convert their funds into gold. Bankers did not evince any uneasiness over the situation and are freely loaning on commercial paper. They pronounce the industrial situation as sound, owing to the general policy of contraction and the absence of all inflation.

Electrically speaking, there was practically nothing of interest in the market. The low point in General Electric since the Venezuelan panic was recorded on Monday, it being 24½. In subsequent days it sold at 26½, and on Saturday ranged about the latter figure. There is a dearth of financial news about the property. From the trade standpoint there were a number of developments, among them the booking of contracts for mining equipment in South Africa and a $200,000 contract for mine equipment at Ogden, Utah. The third-rail surface line of the Nantasket Beach is commanding the attention of railroad men throughout the country. I am told that the Manhattan Elevated company had its engineers on the ground the Fourth of July, with a view of testing the efficiency of the line in handling large cars on that day. It is said that between now and January 1 the Manhattan company will place its order for electric lighting, and it would not be surprising if, at the same time, it contracted for electrical equipment.

The most important out-of-town electrical development was the advancement of the Milwaukee & Waukesha franchise, for a surface line between those two cities, to a third reading in the Milwaukee Common Council. I am told that this ordinance will be passed, and that work will be begun and completed this year. I understand that the contract has not yet been let, and that there is a field there for a large bill of goods. McLean Bros., of Milwaukee, are likely to be the contractors.

On the Boston Exchange, Bell Telephone was quiet and strong. It advanced from 201 to 202½. Erie Telephone was unchanged at 68; New England Telephone reported a few sales that advanced the bid price from 93½ to 95. In Philadelphia Electric Storage stocks were weak, the common dropped a point and the preferred a fraction. Final prices were 24⅜ and 27¾, respectively. Pennsylvania Heat, Light and Power lost a point, closing at 12⅝.

The 4,225 shares of American Bell Telephone stock, sold this morning by auction through Francis Henshaw & Company, of Boston, by order of the directors of the company, were taken by Frank Seabury & Bro., at 203½.

There were very few developments of importance in the New York rapid transit situation, although there are many schemes brewing. The most significant move that came to a head this week was the filing at Albany by the Metropolitan Street Railway Company of a certificate of an increase in its capital from $16,500,000 to $30,000,000. It is understood that this is a part of the plan to increase the capital of the parent company, the Metropolitan Traction Company, from $30,000,000 to $50,000,000. This stock will be issued and the street railway stock held in the treasury against a proportionate share, according to the well known policy of the Traction company. The increases are to be used in acquiring additional lines and real estate. The move gives color to reports of general consolidation of important rapid transit lines in New York city. Nothing was done at the Rapid Transit meeting on Thursday. Manhattan representatives failed to show up. It begins to look as if these later know about what they can do with the city and are biding their time, in the meantime completing their plans regarding electric motors. BAIN.

New York, July 11, 1896.

Thayer & Company, Incorporated.

Messrs. Winthrop Thayer, 1015 Tremont Building, Boston; W. C. Turner, 542 Drexel Building, Philadelphia; Frank A. Thayer and Rodney Thayer, 145 Taylor Building, 39 Cortlandt street, New York city, have incorporated the firm of Thayer & Company, to place on the market the Cahall vertical and the Babcock & Wilcox horizontal safety water-tube steam boilers, built by the Aultman & Taylor Machinery Company. Both these boilers have a good record, and, with the enterprise of the members of the new firm, success should be assured.

Western Telephone Construction Company Not in Any Combination.

The officers of the Western Telephone Construction Company, of Chicago, issued the following statement last Saturday:

It having been stated that the Western Telephone Construction Company was in a combination with other manufacturers, that company has deemed it advisable to absolutely deny in full any such statement. It warns the public against placing any confidence in people who have misrepresented their position and states positively that it is not in any combination, and has made no arrangement whatever in conjunction with other so-called telephone manufacturers to join in defending telephone suits.

The officers of the Western Telephone Construction Company say that it has carried all of its own legal expenses in connection with patent cases without any assistance or aid in any manner from any other telephone manufacturer, that several other manufacturers circulated reports of patent suits which the Western Telephone Construction Company assert have thus far resulted in victories for it, and that patent suits having been now brought against others of these companies, the rumor is being circulated that the Western company will back up these suits. This the Western company wish to deny fully, and say that all others will have to take care of themselves, that it will fully protect and defend all of its own customers, but will refuse to take any part in patent suits brought against the users of other apparatus than that manufactured by it.

High-Power Projectors.

The high-power marine projectors built by the Rushmore Dynamo Works, Jersey City, N. J., are claimed by the makers to have replaced nearly all the old reflector lights as well as many of the finest French and other projectors. The power and penetration of these lights is said to far surpass the finest apparatus previously used in the navies. They are making these lights in large numbers, and, with their improved lens-making plant, have succeeded in reducing the price to less than that obtained last year for the old style locomotive reflector lights.

They have sold over 100 lights this year for naval and commercial vessels, the acceptance of each light being subject to its giving entire satisfaction, and so great has been their success that every light shipped has been promptly accepted. They have installed this season over 50 complete electric fountain lights, including 15 for the Union Traction Company for their handsome electric fountains at Willow Grove, Philadelphia, and they are now building a 100,000,000-candle-power projector for the tower of the new Siegel-Cooper Building, New York city. This light will be visible 50 miles at sea.

S. K. C. Specialty Company.

The third meeting of the creditors of the S. K. C. Specialty Company will be held at Pittsfield, Mass., on July 21, when the account of the assignee will be presented.

PERSONAL.

Mr. F. S. Terry, of Chicago, was among recent out-of-town visitors to New York.

Mr. L. H. Rogers, of the Adams-Bagnall Electric Company, Cleveland, Ohio, visited New York last week.

Mr. Charles F. Cutler, president of the New York Telephone Company, of New York city, sailed for Europe last Saturday.

Mr. Phillip Moen, of Washburn & Moen Manufacturing Company, of Worcester, has been enjoying a yachting cruise on Long Island Sound.

J. W. Braid has been appointed chief of the electricity department of the Tennessee Centennial Exposition, which opens at Nashville, Tenn., on May 1, 1897.

General Manager Hooker, of the Perkins Electric Switch Manufacturing Company, Hartford, with his cruising cat-boat, has joined the Ft. Griswold coterie at New London harbor.

The many friends in the electrical field of Wm. Littlefield, of the S. S. White Company, of Philadelphia, will be glad to know that he is rapidly convalescing after his long illness.

Mr. Thomas A. Edison last week packed his grip, said good-bye to "the boys" in his laboratory and started away on a two weeks' vacation, the first he has taken for many years. He is doing this by the advice of his physician, who says Mr. Edison is overworked. He didn't say where he was going.

Mr. Charles E. Newton, of the Jewell Belting Company, of Hartford, was present at the opening of the new Norwich electric light plant and received many congratulations for the system of belting installed there, being perhaps the most perfect equipment of the kind in the world, as the main belt was the one made for exhibition at the World's Fair.

Frank C. Mason, superintendent of telegraph of the Brooklyn, N. Y., Police Department, has received an invitation to attend the international congress of electricians to be held at Geneva, Switzerland, from August 4 to 9. He has also been asked to address the congress on the subject of "Police Telegraph for Municipalities." Mr. Mason will not attend the congress, but has consented to send a paper on the subject named.

Telephone Facilities at the Chicago Convention.

Manager A. S. Hibbard, of the Chicago Telephone Company, provided excellent telephone facilities for transmitting the news from the Democratic convention held last week in Chicago. Each newspaper in the city had a direct line from the convention hall to its editorial rooms. Mr. Hibbard had three of the best seats on the platform and a private telephone line of his own. Among his guests was the San Francisco telephone magnate, Mr. John I. Sabin.

THE TELEPHONE IN RAILROAD PRACTICE.

READ BEFORE THE ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS, FORTRESS MONROE, VA., JUNE 17, BY W. W. RYDER, OF CHICAGO.

The growing use of the telephone in railroad work and its present advantages and future possibilities is a subject well worthy of consideration and study.

The telephone equipment at local points best adapted to the transmission of the internal business of a railroad, depends upon the location and degree of concentration of the offices at each point. The value of a private telephone line connecting intermediate points and the division headquarters along the line of the road is dependent to a large extent upon the number of instruments that are enabled to secure intercommunication thereby.

In connection with the speaking tube or internal telephone system, special efforts are being made by the local telephone companies to offer the railroad companies instruments and apparatus that vary with the character of the service desired. For instance.

System A—A central switch with lines radiating from it, each line having one or more stations connected with it, the whole being arranged for intercommunication.

This system is operated in much the same manner as an ordinary telephone exchange, a switch being located at some central point, provided with means for calling and receiving calls from each station, and for connecting the several stations with each other. The switch may be located where it can be operated by some person in connection with other work, or if the system is large, the services of a regular operator may be required.

This system (if but one station is connected on each radiating line) secures secrecy between any two stations and provides for independent communication between a number of stations at the same time.

System B—A switch at a particular office with lines radiating from it, each line having one or more stations connected with it, the whole being arranged for communication to and from this particular office, but not for communication between stations on different lines.

This system is used for transacting business between a particular office and several stations in cases where it is not required that the stations communicate with each other. A switch is provided at the main office only.

This system (if but one station is connected on each radiating line) secures secrecy between the main office and any one of the stations.

System C—A switch at each station, with means for connecting the instrument at such station with lines extending to each of the other stations.

This system is so arranged that a person at any station can call any other station over a special line and establish the desired connection without the aid of an operator. It does not secure secrecy to such a degree as systems "A" or "B." A switch being located at each station, access may be had to all circuits whether in use or not, but as the bell at the desired station is the only one operated when a call is made, secrecy is fairly assured, and interruptions are not likely to occur unless the use of the same circuit should be desired by a second party and his instrument be connected for the purpose of making a call. It is possible for parties at several stations to converse independently with each other at the same time.

System D—A single circuit connecting two or more stations.

All instruments being connected upon one circuit, no switching apparatus is required. Only two stations can use the line at one time and there can be no secrecy, as a call made from any station will ring all bells simultaneously.

Systems "A" and "B" are especially adopted and serviceable for freight offices and yards, round houses, switching towers, etc.

System "C" is perhaps the most convenient and satisfactory when the stations to be connected are not numerous.

System "D" is the most simple and inexpensive.

An outgrowth from system "A" is the present private branch telephone exchange. The benefits derived from the establishment and operation of private branch exchanges seem comparatively unknown, and especially so to those who have not been closely in touch with the growth of this particular line of the business, and it is with a view of arousing interest in this direction, as well as securing additional information through the discussion which I trust will follow this paper, that I have endeavored to collect as much reliable information as possible bearing upon the subject. This very lack of familiarity with the branch exchange frequently results in a much less efficient service from a given number of telephone lines than would be secured were they merged into the so-called exchange.

"In the march of civilization the improvements of yesterday are discarded for those of to-day. The tin speaking tube once used for interior communication gives way to the telephone. In this age when only time saving is considered more important than labor saving, and the combination of both is the prime object with all active minds, the importance of rapid and reliable communication can not be over-estimated. Especially true is this of the business conducted in a large building where the labor and delay incidental to employing messengers or office boys, make an important item of expense. In the general offices of a large railroad company, where every office can be connected one with another, and the various working departments be brought into talking relations with one another, this telephone service is a time, labor and money saver; and where the heads of departments are separated from each other by doors, stairs and passages it is invaluable."

Every railroad man is familiar with the general scheme of railroad organization, and the relationship between the various departments, their chiefs, etc. The lines of authority are closely drawn, and the flow of communication naturally follows these divisional lines.

As the division of responsibility among the several officials and employés who carry on the operation of the railroad company is plainly defined, so the uses of the telephone tends to parallel those divisions of responsibility and to follow the lines which separate the duties which are to be performed.

In the application of the telephone to the transaction of internal business at local points and within a certain radius of the office building or about the yards and switching centers, the numerous communications necessary are passed to and fro easily and without loss of time.

The tendency is toward the constant growth of private branch exchanges, as they give more perfect interchange of communication for every class of business, concentrate the service within certain limits and enable the business to be transmitted direct without going through the medium of the local telephone operator, and vary the class and extent of the service desired according to the price paid.

The benefits to be derived from the operation of the private branch exchange has been recognized to a greater exent in the city of Chicago than elsewhere in the country. As a matter of fact there are at present in that city over 130 private branch exchanges, operating an aggregate of over 1,200 telephone instruments. These exchanges are operated by railroad and express companies, large wholesale and retail establishments, manufacturers, etc., and range in extent from four to 100 instruments. They are connected by means of trunk lines with the local telephone company's exchange, so that connection may be had with the public.

In a great many cases a particular telephone, while greatly needed for the handling of railroad business, has no occasion for public connection. If arranged so that they can secure such connection, the result is that the telephone will be used more or less for private ends; consequently, when the public trunk lines are required for legitimate railroad business, they will be reported "busy," while, as a matter of fact, they are being used for private business.

To obviate this evil and to furnish as nearly as possible what is absolutely required, the local telephone company has recently adopted a scheme whereby it is made impossible to give certain offices public connection, although they are able to secure unrestricted intercommunication with every line radiating from the branch exchange. In giving this limited service, the telephone company charges a considerably lessened rental, although securing for the subscriber a more efficient service by not allowing the unnecessary blocking of his down-town trunk wires. This difference in expense together with the difference in price between public and branch exchange lines is almost, if not quite, sufficient to pay the salary of the telephone operator even though you have only a small number of lines, and this naturally increases with the greater extent of the system.

The success of the system can best be indicated by the statement that of all the branch exchanges put in operation in the City of Chicago, only one has ever been taken out through dissatisfaction with the system, and in this case it was only a short time before the telephone company was requested to immediately replace it, the firm finding that the inconvenience and loss of time were greatly increased when the exchange was closed.

The growth of the private branch exchange system must soon extend along the lines of the individual railroads; in fact, at present the Pennsylvania Railroad Company has in operation a very complete system which gives them direct connection over wires entirely controlled by them between all division headquarters on their road east of Pittsburgh. Through the courtesy of that company I am permitted to exhibit a diagram of this system. They have branch exchanges at all division headquarters and have leased from the Long-Distance company necessary wires to complete connections with these points. Other large eastern lines, I understand, are now contemplating the adoption of this same scheme.

With the growth of the private branch exchange idea, these exchanges will rapidly multiply in large cities and the necessity for means of intercommunication between them without going through the public exchange will become imperative; in fact, in the City of Chicago, at present, where branch exchanges are being operated by the Chicago & Northern Pacific, Chicago, Rock Island & Pacific, Chicago, Milwaukee & St. Paul, Chicago & Eastern Illinois, Illinois Central, Chicago & Northwestern and Chicago, Burlington & Quincy Railroad companies this necessity is very noticeable, and the local telephone company is considering the question of trunking the different exchanges together. With this accomplished, it is but a step to the connection of the branch exchanges in one city with those in another over wires controlled by the railroad companies. How this can best be done can only be decided by trial, and I believe we will have to meet this particular issue at a very early date.

When we consider the rapid growth of the telephone system, it seems a question of only a short time before the telegraph will be largely superseded by the telephone. It has been shown in actual practice in commercial service that messages of 30 words can be readily and intelligently transmitted in a quarter of a minute, or 120 words per minute, which is

about 3,900 better per hour than the average by Morse, using the Phillips code and the typewriter. The above record is taken from a guaranteed service where the toll service is daily performed on this basis.

The question of the telephone not being able to compete with the telegraph on account of the lack of records was happily answered, you will recollect, by Superintendent Selden in a paper read before this association at the 1894 meeting. and this feeling, I believe, is rapidly passing away.

The dispatching of trains by telephone has been tried with perfect success in several instances in this country. This is the most exacting of service, and the fact that it is a success speaks volumes for its efficiency.

It is a well known fact that large corporations are slow in adopting radical changes, but the improvements in telephone apparatus are so marked and the benefits derived from its use so evident, that they are being forced to recognize its merit and consequently are rapidly advancing the movement.

A Home-Made Electric Ventilating System.

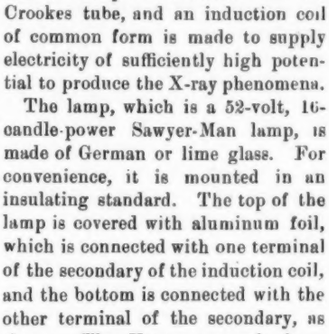
In the *Times* Building, New York city, there is an interesting home-made ventilating system in operation. When the architect of this building designed it, it was the first of the modern sky scrapers in New York, and, consequently, it contains many faults which do not occur in office-building construction to-day. One of these faults is that the boilers are located beneath the sidewalk and the flue is carried in overhead piping just below the ceiling of the basement to the smoke stack, which is located almost on the other side of the building. In spite of the fact that this flue is heavily covered with asbestos, considerable heat is lost. In fact, on numerous occasions the temperature of the basement rose to 1 2 and 114 degrees. The management of the building desired to ventilate this basement at least, to the extent of causing a circulation of air. Several concerns were called upon to undertake the task, but none of them would give a guarantee as to the success of their plans. Finally, the chief engineer of the building decided to do the job himself. Just on top of the flue, from the boilers, he ran a ventilating pipe of galvanized iron with numerous openings. This pipe was attached to a 10-horse-power Lundell exhaust fan, which drew the hot air from the basement and sent it up a pipe shaft to the roof. The object desired was accomplished at a lower cost that any of the contractors wanted to do it for and at the same time a reduction in the temperature of the room of from 8 to 12 degrees has been obtained.

The Pilots' Association of New York have completed plans for a steam pilot boat, the first in the world. She will be equipped with all conveniences, including electric lighting, and will have a speed of 14 knots an hour.

Inexpensive X-Ray Apparatus.

The expense of special Crookes tubes, powerful coils and batteries has deterred many from entering this interesting field of experiment; but, says the *Scientific American*, Mr. R. McNeil, of this city, has recently devised apparatus in which an ordinary incandescent lamp is substituted for the Crookes tube, and an induction coil of common form is made to supply electricity of sufficiently high potential to produce the X-ray phenomena.

The lamp, which is a 52-volt, 16-candle-power Sawyer-Man lamp, is made of German or lime glass. For convenience, it is mounted in an insulating standard. The top of the lamp is covered with aluminum foil, which is connected with one terminal of the secondary of the induction coil, and the bottom is connected with the other terminal of the secondary, as shown. The X ray proceeds from the cathode. By means of the fluoroscope the shadows of the bones of the hands and feet, also of the limbs, may



INEXPENSIVE X-RAY APPARATUS.

be seen, when they are placed between the instrument and the lamp.

It has been found in this experiment that when a blue fog appears in the lamp, the vacuum is too low for the best results. By placing the lamp in the house circuit for 15 or 30 minutes, the high vacuum is restored by the heat, and will remain good for about 15 minutes.

The coil is capable of giving a three-inch spark, and the X ray produced by this simple and inexpensive apparatus is sufficient for making radiographs.

Soldering Glass.

Recent investigations by Margot have established the fact that an alloy, composed of 95 parts of tin and five of zinc, melts at 200 degrees centigrade, becomes firmly adherent to glass, and is unalterable and exhibits an attractive metallic lustre, says the *Engineering and Mining Journal*. An alloy, consisting of 90 parts tin and 10 of aluminum, melts at 390 centigrade, becomes strongly soldered to glass, and is possessed of a very stable brilliancy. With these two alloys it is possible, it is claimed, to solder glass as easily as it is to solder two pieces of metal, and this operation may be done by soldering the pieces of glass, when heated in a furnace, by rubbing their surface with a rod of the solder, the alloy as it flows being evenly distributed with a tampoon of paper or a strip of aluminum, or an ordinary soldering iron can be used for melting the solder.

ON THE INVISIBLE RADIATIONS EMITTED BY PHOSPHORESCENT BODIES.

BY H. BECQUEREL IN "COMPTES RENDUS."

The experiments carried out by the author on the invisible radiations emitted by phosphorescent bodies were made with crystalline slips of the double sulphate, $S\,O^4\,(U\,O)\,K + H^2O$, of which the phosphorescence is very active, and the duration of persistent luminosity less than one-one-hundredth second. It is found that the radiations emitted by this substance, after exposure to sunlight or diffused daylight, not only pass through sheets of black paper, but also through certain metals, such as aluminum and thin sheets of copper.

The experiment was made by exposing to direct sunlight a photographic plate inclosed in a dark slide consisting on one side of an aluminum plate. Under these conditions no effect was detected, but if, on the exterior of the aluminum plate, there be placed a slip of the uranium salt, it is then found that its silhouette appears on the plate after an exposure of several hours to sunlight. If there be placed between the slip of uranium salt and the sheet of aluminum a piece of copper about 10 millimetres thick and cut to a certain shape, its image will appear on the plate with a lighter tint, but showing that the radiations have passed through the copper. The phosphorescence produced by sunlight reflected from the metallic mirror of a heliostat and then refracted by a prism and a quartz lens gave rise to the same phenomena.

The following experiment is of considerable importance: The same crystalline slip, under the same conditions as the above, but sheltered from the source exciting the radiation, and placed in the dark, was found to still produce the same photographic effects. The experiment was performed by inclosing a photographic plate in a thick cardboard box and placing on its sensitive face a slip of uranium salt of convex shape, and thus only touching the film at several points. At the side of this, and on the same plate, was placed a second slip of the same salt, separated from the surface of the gelatino-bromide by a thin film of glass; the experiment being performed in perfect darkness. The same was done with a plate inclosed in a dark slide, one side of which consisted of a sheet of aluminum. on which were placed the slips of uranium salt.

After five hours, the plates were developed, and the images of the slips appeared as before, in the same manner as when the slips had been rendered phosphorescent through the action of light. With the convex piece, which was placed directly on the gelatine, there was practically no difference in the action between the points of contact and those parts which were about one millimetre distant from the gelatine. The action of the slip placed on the sheet of glass was very slightly weakened, and its shape was very sharply reproduced. The effect through the sheet of aluminum was considerably weakened. The author observes that this phenomenon does not appear to be attributable to luminous radiations emitted by phosphorescence, as after one-one-hundredth second these radiations have become so weak that they are scarcely perceptible. The author's hypothesis is that these radiations, of which the effects are very analogous to the radiations studied by MM. Lenard and Roentgen, may be invisible radiations emitted by phosphorescence and of which the duration of persistence would be infinitely greater than the duration of persistence of luminous radiations emitted by this body.

Willyoung Induction Coils with Adjustable Condensers.

Mr. James G. Biddle, Drexel Building, Philadelphia, is meeting with marked success in introducing the new Willyoung induction coils with adjustable condensers. This apparatus is built upon correct, improved, scientific lines and is fully equal in grade of workmanship and efficiency of results to the best types which have been made heretofore only in England and France. When properly handled, each coil is guaranteed to produce a continuous discharge of the rated spark length without break down or other injury.

The adjustable condenser—original with Messrs. Willyoung & Company—is a feature of great value, for it enables the discharge to be varied through wide ranges and adapts the vacuum tube to different degrees of exhaustion. The advantage of this condenser over the form previously used is precisely the same as that of an adjustable field rheostat over one of fixed value. While the Willyoung coils are superior for any work that requires such apparatus, the greatest demand at present is naturally for X-ray coils, and particular attention is devoted to this department. Each detail of construction is watched with utmost care, and the following remarks from a prominent purchaser indicate the manner in which the apparatus operates. Mr. W. W. Griscom, president of the Electro-Dynamic Company, writes under date of June 26:

"I am highly pleased by the behavior of the coil which you last sent me. I do not think it could be possible for a coil to work any better. It gives a splendid stream of sparks at six inches, and occasionally a spark would strike across a distance of eight inches. I congratulate you on the success of the various experiments and beg to thank you for your efforts in getting me the best possible coil, and for your kindness in adding the little practical improvements."

Messrs. Willyoung & Company make a specialty of constructing coils of large size and are also prepared to fill orders quite promptly. Mr. Biddle will be glad to furnish price list and further particulars upon request.

THE ELECTRIC LIGHT IN MINING OPERATIONS.

BY WILLIAM BAXTER, JR., IN THE "ENGINEERING AND MINING JOURNAL."

The use of the electric light in mining operations has not been as extensive, up to the present time, as it should have been, considering its superiority, as an illuminant, over the ordinary lamps, but it has been sufficient to show that its value in this field will prove to be as great as in any other. Good illumination is of the greatest benefit in all classes of manual work, and mining is not an exception to the general rule.

It may be that the cost of electric light is believed to be so much greater than that of oil lamps as to make its use prohibitive, and this may account for the slow progress it has made in this field. But that its cost should be so high as to offset its decided advantages is by no means certain. If the actual value of the oil only is taken into account, in calculating the cost of the present method, the comparison would undoubtedly show up in a manner that would be anything but favorable to the electric light, and, in fact, would probably justify the conclusion that the latter can only be regarded as an expensive luxury. If, however, to the cost of material is added the expense of preparing the lamps for use, and that of caring for them afterward, it may, and in all probability can, be shown that the dim and otherwise unsatisfactory oil lamps are not so very much cheaper after all.

Although but little has been done in the way of introducing the electric light into mines up to the present time, it can not be said that for this purpose it is still in the experimental stage; for enough has been accomplished to demonstrate conclusively that it is thoroughly practical, and all that could be desired. It is safe, and by far more efficient as a means of illumination, than oil lamps, and, judging from the experience obtained in other fields, it should have the effect of enabling the workmen to do more and better work, and with far less danger not only to themselves, but to others as well.

There is one difficulty, however, in adopting electric lights in many places (and this difficulty affords room for the display of ingenuity and the development of improvement over present methods), and that is, that the lamps that are used near the headings when heavy blasting is done would almost surely be destroyed when the blasts are set off. The most common expedient resorted to to get around this difficulty heretofore has been to set up these lamps in a portable manner so that they may be removed whenever necessary. Another plan is to place them where they will be sheltered as much as possible. The former method has been tried with very good success in several places, and there appears to be no reason why it should not be perfectly practical.

It may be raised as an objection to this plan that it can not be very durable, for the reason that no matter how well protected or how flexible the cables may be, the frequent moving back and forth will soon wear them out. This is true to a very great extent, but just how great an objection this would turn out to be in practice no one can say at the present time, as only the actual results of long usage can throw any positive light upon the subject. This objection, however, applies only to mines where heavy blasting is done, and these, probably, do not constitute so great a proportion of the whole mining industry as to render the prospects of the electric light in this field hopeless, should it be found from future experience that in such cases it is not adaptable. But, even in mines of this class, if the necessity of removing the lamps should prove to be a fatal objection, it would not mean the total exclusion of the electric light, because this difficulty can be overcome by adopting a system of reflecting the light from one part of the mine to another. This system could be made thoroughly practical in every respect, and in point of economy would be ahead of the methods that have been used so far, as with it arc lights could be employed, and these would give a much greater illumination for the same cost than is obtained with the incandescent lamps which have been used almost exclusively up to the present time.

This system, briefly explained, would consist in using arc lights, located in sheltered positions and projecting their light, by means of suitably disposed reflectors, upon the headings. There are several good arc lamps, now on the market, that are adapted to the incandescent light current, and any of these could be used for the purpose. The way in which this system would be arranged would be as follows:

At a distance of, say, 100 or 200 feet from the heading, the arc lamps would be located in a place where they would be well protected against injury when the blasts are set off. Back of each lamp a reflector would be located in such a position that it would project the rays of light toward other reflectors from which it would be cast upon the headings, where the work was being done. These latter reflectors would have to be in an exposed position, but the lamps would be placed out of harm's way, and, therefore, would not have to be removed.

The reflectors being exposed might be broken occasionally by flying rocks, but this would not be very often, as they would be 100 feet, or more, away from the point where the blasting was being done. But if they should be broken even more often than occasionally it would not add much to the cost of lighting the mine because they could be made at a very low price. The advantages of this arrangement would be that a much greater amount of light could be obtained for the same cost, owing to the fact that arc lights give so much more light from the same power; and, also, that a greater amount of light could be concentrated at any desired point. These would be the most conspicuous advantages, but they would not be the only ones; there are several others, which; although of a somewhat minor importance, would, when taken collectively, amount to fully as much as the reduction in cost, and increase in quantity of light.

It must not be inferred from the foregoing that it is assumed that this system would furnish the illumination of a mine at a cost lower than that of oil lamps; the comparison is wholly between incandescent and arc lights.

When good illumination is desired it would probably be necessary to use two or more arc lamps to light up a heading, but in many cases one would be sufficient, provided the reflectors were so located that they would properly diffuse the light, and thus avoid shadows as far as possible.

This could always be done, because the light of the lamp could be concentrated in a beam by a suitable reflector, such as are used aboard ship for search lights, and the reflectors that throw the light upon the heading could be placed in a line one ahead of the other and as far apart as the surroundings would permit. The reflectors, being all in line, would receive the rays reflected by the main reflector, and, being turned to the proper angle, would cast the light upon the heading, and as the illumination of the latter would come from the several reflectors, shadows would be almost entirely eliminated.

Kamm's Zerograph.

Having learned that the government was inquiring into the merits of an invention of Mr. Leo Kamm's which, if its accomplishment came near its promise, was like to revolutionize the present system of telegraphic communication, I was anxious to get some clear idea of it, says a writer in London *Black and White*. My attention was directed to a couple of bamboo tables at opposite ends of the room. At the foot of each was an electric battery, whence wires ascended to an instrument on the table. This instrument resembled an ordinary typewriter, and held a roll of paper marked with typewriting.

"It looks like a Remington combined with a telegraphic apparatus," I remarked.

"That is just what it is. It is a telegraphic instrument that, instead of printing dots and dashes on a strip of paper, typewrites a message on a sheet of letter paper at both ends of the wire simultaneously. The two machines are identical in every respect, and can be used indifferently as transmitters or as receivers."

"How is it worked?"

"The operator depresses the keys, as in ordinary typewriting, and this causes a current from a local battery to disengage a balanced pendulum in both machines. There are 36 signs for letters, numerals and spaces. You observe this circular framework, consisting of 36 upright bars? The machine is constructed so that it takes half a second for the pendulum to travel from end to end of this framework, and fractions of half a second (down to a thirty-sixth) for it to move between various intervening bars. Now, the letter or numeral printed will depend upon the space moved by this pendulum; in other words, upon the length of time which elapses between two successive electrical impulses. There are various automatic devices for moving the paper, adjusting the alignment, inking the letters, and so on. The fundamental principle whereon the machine is worked is the absolute synchronism between the two instruments. But for this absolute synchronism—isochronism is the precise term—it would be impossible to produce the same symbols at both ends, because the difference between one sign and another resolves itself into minute difference of time."

"Of course, your instrument represents a great advance on the Morse dots and dashes; but is there not an instrument already in existence that prints telegraphic messages?"

"Yes, the Hughes apparatus; but my invention has certain advantages. It prints on an ordinary sheet of paper in lines and paragraphs. Instead of requiring an experienced telegraph operator, it can be used by any one who typewrites. In can be used in private offices like the telephone, and worked at all times of the day or night without the intervention of telegraph officials. The machine is automatic, and delivers its message whether there is or is not some one at the receiving end. It also has the advantage of dispensing with clockwork, motors and other cumbersome and costly devices. It can be worked on the exchange system. It fact, it combines the functions of typewriter, telegraph and telephone."

"If it can do all this it will work a revolution in telegraphy. It will not be long before every business office is provided with its zerograph, in addition to its telephone and typewriters."

"Only the sanction of the post office is needed to bring it into general use."

"How about speed in working?"

"It is quite equal to anything hitherto obtained, if not faster—more particularly for long distances, the electrostatic capacity to be overcome being considerably less in the case of the zerograph. Whereas other instruments operate at a speed of 25 to 30 words a minute, I can see my way to increase my present speed to 40 words a minute."

"It will be an expensive instrument?"

"No; it can be turned out as a column-writer at about the same cost as a Standard Remington—say from £15 to £20."

"Have you been long in developing the idea?"

"About five years. Here are models of the different stages through which it has passed."

TELEPHONE NEWS AND COMMENT.

The subway question is receiving considerable attention from the city authorities of Syracuse, N. Y.

The Southern New England Telephone Company is doing considerable underground work in New Haven, Ct.

Moline, Ill., expects soon to be connected with the long-distance system of the American Telephone and Telegraph Company.

The business men of Erie, Pa., have organized a mutual telephone company, the capital stock of which will be $60,000. Each subscriber is to be a stockholder.

The Citizens' Telephone Company, of Grand Rapids, Mich., claims to have 900 telephones connected with its exchange, and states that by the middle of July it will have 1,700 instruments installed.

The message-rate system is becoming very popular in Kansas City, Mo. Manager Burt has in service a new kind of telephone in which a card is placed on the inside of the case. Each call is automatically registered.

It is estimated that the telephone system of St. Louis suffered during the recent tornado to the extent of $80,000. Over 3,500 miles of wire were knocked out, 30 aerial cables were broken, and the company lost about 400 poles.

A telephone company has been organized in Michigan, known as the Bad Axe Telephone Company. Mr. S. L. Bennett, of Bad Axe, in that State, is manager. We trust that he will hew out a successful career in the telephone field.

The Northwestern Telephone Company has leased new quarters at Minneapolis, Minn., which, after being remodeled, will be occupied the latter part of the year. The company intends to make a material increase in its working force.

The new telephone line connecting Portland, Lewiston, Augusta and Bar Harbor, Me., is rapidly nearing completion. The construction work has been especially difficult, as in many places the line passes over a rocky country, necessitating the blasting of pole holes.

The Central Union Telephone Company has filed a 20-year six per cent mortgage for $3,000,000 in favor of the Illinois Trust and Savings Bank, of Chicago. It is payable in gold and the interest is due semi-annually. The mortgage must be filed in 28 counties in Illinois, 23 in Indiana and 47 in Ohio.

Mr. J. E. Keelyn, president of the Western Telephone Construction Company, of Chicago, said in a recent interview: "We have already installed in the United States about 300 public telephone exchanges, varying in size from 50 to 2,000 telephones each. Some of these have been in operation for two years or more."

The Postal Telegraph-Cable Company expects to rapidly extend its lines in southern territory, ultimately giving it connection with Mexico. President A. B. Chandler recently said that the company was not interested in the telephone business and only sought commercial telegraph business.

A company has been formed, known as the Kanawha Valley Telephone Company, for the purpose of connecting Pt. Pleasant, W. Va., and intermediate towns with Charleston, W. Va., a distance of 60 miles. The new company has signed a contract with the Kanawha Telephone Company, of Charleston, for exchange service for 10 years.

It is reported that the Phœnix Telephone Company, of Indianapolis, Ind., has expressed a willingness to have a clause inserted in its franchise providing that outside telephone companies may have an entrance to the city over its wires. It is expected that one result of this will be to form a State telephone system with a central exchange in Indianapolis.

Mr. L. G. Bowman, formerly in charge of the Spring street exchange of the Metropolitan Telephone and Telegraph Company, New York city, has been appointed manager of the Home Telephone Company's exchange at Fort Wayne, Ind. Mr. Bowman has had excellent experience and training in the telephone business and should prove a valuable man in his new position.

The message-rate system which was to have gone into effect at Pittsburgh on July 1 has been postponed to allow new rules and contracts to be made covering the new style service. It has been suggested that a rebate be allowed to all who use less than the number of messages contracted for. This rebate, however, does not apply where the number of calls is less than 600.

The La Crosse Telephone Company, of La Crosse, Wis., have purchased a 900-switchboard equipment from the Western Telephone Construction Company, of Chicago, to take the place of apparatus formerly in use. The new Keelyn system of central office equipment will be used. It is a compliment to this apparatus that the La Crosse people should pay over four times as much for it as was asked by the next highest bidder.

The Western Telephone and Telegraph Company's Ohio line has been completed as far as Fort Wayne, Ind. It will operate in connection with the Home Telephone Company's exchange in that city, and will give the people of Fort Wayne long-distance communication with towns lying to the East in Indiana and Ohio. The Home Telephone Company's exchange is connected with over 50 towns, and toll stations are established as far East as Lima, Fostoria, Defiance and Findlay, Ohio. The line is also being extended toward Toledo. Mr. George W. Beers, president of the company, is the moving spirit in the enterprise and is going about his work with enthusiasm and intelligence.

A local paper says that recently Charles H. Berger sat in his office in Harrisburg, Pa., when there came a summons for him to attend a telephone call. He went to the telephone. At the other end of the line, in Pottsville, was Judge Savidge, who was holding court there. It seems that in 1889 Judge Savidge had heard Mr. Berger argue a case in the Supreme Court, in which he referred to a certain case in support of his argument. In a cause on trial before him the other morning Judge Savidge wanted to refer to that case, but he could not remember it. He ordered a recess to be taken, went to the telephone, called up Mr. Berger in Harrisburg, asked him for the name of the case and where it could be found, which information was given him, and in five minutes the court was again doing business.

A British Estimate of Lord Kelvin.

[*From London Lightning.*]

The "Handbooker" in the *Referee* fills nearly two columns with chatter, *more suo*, about Lord Kelvin's jubilee. He claims to be a pupil of Lord Kelvin's, and prides himself on knowing some things "to which Sir Isaac Newton was a stranger;" yet he can find nothing in Lord Kelvin's work "stronger" than his omission to supply Burke with the name of his grandfather. He thinks to do honor to his master by comparing him with Shakespeare [!] to the disadvantage of the poet. This reminds me of the silly comparisons current some 20 years back between a steam engine and a violin. The "Handbooker" claims that his bent of mind is scientific. Did no one ever teach him that ratio can only exist between things of like kind? Would any one think of comparing the flavors of a pheasant and a strawberry, or of likening either to the tint of a rose? If we must needs turn over the records of great Englishmen to find one with whom to compare the great Scotsman whom we all to-day delight to honor, it is the roll call of science, not of literature, to which we naturally turn, to find there, conspicuous above all others, the name of Newton, *qui genus humanum ingenio superavit*.

Doubtless Lord Kelvin would be the first to deprecate such a comparison. No man living is more able to appreciate at its full worth the transcendent mathematical genius of Newton, and to shrink from the arrogance of being supposed to emulate it. Yet between things like in kind comparisons *are* possible, and there are many points of resemblance between these two intellectual giants. Like Newton, Lord Kelvin, living in an age of great mental activity, towers a head and shoulders above his contemporaries. First and foremost a mathematician, he yet, like Newton, is skillful and successful in experimental questioning in nature; indeed, he is more likely to be remembered by his mechanical triumphs than by his speculative theories, while Newton's telescope is well-nigh lost sight of in the light of Newton's reorganization of our ideas of the universe. Yet Lord Kelvin himself would probably attach more importance to the latter, the higher efforts of his intellect, even while confessing failure. "*Hypotheses non fingo*," said Newton. Lord Kelvin was always framing hypotheses, yet at the end he says:

One word characterizes the most strenuous of the efforts for the advancement of science that I have made perseveringly during 55 years; that word is failure. I know no more of electric and magnetic force or of the relations between ether, electricity, and ponderable matter, or of chemical affinity, than I knew and tried to teach my students 50 years ago, in my first session as professor.

The failures of men like Lord Kelvin are apt to be more fruitful than lesser men's successes; one can hardly read this summing up of his life's work without being reminded of the sentence, too hackneyed for quotation, in which Newton gave his own estimate of the discoveries that had inaugurated a new era for physical science. In their candor and humility, no less than in their single-minded devotion to the discovery of truth, and in their intellectual supremacy, the parallel I have ventured to suggest holds. In one respect our rulers of 200 years ago were wiser than their successors of to day; they knew the value of a great man's leisure. Newton held a lucrative government appointment that made little demand on his time. Heartily as we all congratulate Lord Kelvin on his jubilee, and greatly as his work as a teacher has been appreciated by his pupils, one is tempted to wish that there had been no jubilee to celebrate. The time of such a man as Lord Kelvin is too precious to be taken up with university classes, and much as he has accomplished, it might well have been more yet had he been able to devote himself wholly to physical and philosophical research. Perhaps then the above confession of failure might not have been made, and the secret of the ether might have been unveiled. The riddle of the universe is scarcely nearer being solved now than it was in 1696, and if our mathematical tools are better tempered than those then used, they have tougher metal to cut. Moreover, they were mainly forged for us by Newton's contemporaries—his own weapon was one that none but he could wield—and the workman are perhaps less skillful. It is the more necessary that the few men—one or two in a century, perhaps—capable of handling these high matters should be absolved from even such important work as turning out "Handbookers."

ADVANCE INFORMATION

Valuable News and Tips for Manufacturers and Dealers.

We publish below information relating to new electric railways, new electric light companies, new telephone companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW.

New Electric Railways.

RIVERSIDE, MO.—The Metropolitan Street Railway Company has awarded the contract for the brick work on the electric power plant at this place to W. W. Taylor.

BATTLE CREEK, MICH.—An electric road between this place and Kalamazoo, by way of Augusta, Comstock and Galesburg, with a branch to Gull Lake, is now considered a certainty.

TOLEDO, OHIO—The Toledo Traction Company and the Toledo Electric Street Railway Company filed articles of consolidation under the name of the Toledo Traction Company. The capital stock is $6,000,000.

NEW HAVEN, CT.—The New Haven Street Railway Company is planning to construct a continuation to Silver Sands of the present line to Lighthouse point.

CLINTON, MASS.—It was stated recently by an official of the Clinton & Leominster Street Railway Company that a syndicate, composed of the directors of that road, had purchased the Leominster & Fitchburg road, also the Whalom line.

BOSTON, MASS.—The West End Street Railway Company intends erecting a car house in Brighton at the corner of Wilton and Braintree streets. The estimated cost is $30,000.

FRANKLIN, N. H.—Articles of incorporation have been filed with the Secretary of State by the Franklin Street Railway Company. Capital stock, $20,000.

SUPERIOR, WIS.—The Minnesota Railway Company is planning to extend its line from Itasca, the Omaha's suburb, to Duluth.

CANANDAIGUA, N. Y.—It is rumored that an electric railroad is soon to be built from this place to Seneca Point to connect with the Canandaigua electric street railroad.

CLEVELAND, OHIO—The Cleveland & Chagrin Falls Electric Railway Company has filed a mortgage for $200,000 in favor of the Guardian Trust Company.

GREENBUSH, N. Y.—The Greenbush Heights Electric Railroad Company has been incorporated by William H. Slingerland, Jr., of Slingerland, N. Y.; John C. Unger, of East Greenbush; George H. Welsh, of Albany; G. W. Slingerland, of Hackensack, N. J., and Sanford Warner, of East Greenbush, to build and operate an electric railway from Greenbush to East Greenbush, a distance of four miles. Capital stock, $40,000.

Electric Light and Power.

MANCHESTER, N. H.—The Manchester (N. H.) Electric Light Company has been leased to the Manchester Electric Company, a new company of which P. S. Saltonstall, of Boston, is president, and W. A. Tucker, of Boston, treasurer.

MANASSAS, VA.—The Manassas Electric Light and Power Company has completed negotiations for one of the finest electric plants ever established in a small town. The company will have its own engines and be prepared to furnish power to other enterprises, besides any number of lights that may be wanted.

BURLINGTON, VT.—Almond, Sargent & Company, of Boston, have secured the contract to put in the electric light plant at this village.

POTTSVILLE, PA.—The Anthracite Electric Light and Power Company, of this place, composed of Pottsville capitalists, have sold their franchise and service to Major Heber S. Thompson, S. B. Briscoe, S. H. Kaercher, Col. T. H. Rickert, Jacob S. Ulmer, Jacob Ulmer, of Pottsville; Hiester S. Albright, Orwigsburg, and F. P. Spiese, of Tamaqua.

BIG TIMBER, MONT.—A new electric light plant has been constructed.

FREDERICK, MD.—Frederick Electric Light and Power Company, Frank L. Stoner, attorney, has made application in the Circuit Court for an injunction restraining the municipality of Frederick from levying on the plant of the Frederick Light and Power Company for the collection of taxes claimed by the city to be overdue.

HIGHLANDS, COLO.—The Highlands Electric Light Company has been awarded contract for the erection of an electric light plant.

DELTA, MD.—Delta Electric Power Company has been incorporated by S. J. and H. C. Whiteford.

POINT PLEASANT BEACH, N. J.—Point Pleasant Electric Light and Power Company has been incorporated by Quimby N. Evans, Wm. C. Adams, Juan A. Almirall, Brooklyn, N. Y.; Joseph W. Johnson, Benjamin F. Coles, of Point Pleasant. Capital stock, $10,000.

FOSSTON, MINN.—An electric light plant is to be established, for which bonds will be issued.

UTICA, N. Y.—J. A. Cantwell, City Clerk, may be addressed for information concerning lighting of the streets and public buildings of the city.

VICKSBURG, MISS.—Bonds to the amount of $3 500 are to be issued for the establishment of an electric light plant.

WASHINGTON, D. C.—The Mayor may be addressed for information concerning the construction of an electric light plant.

DENVER, COLO.—The Mountain Electric Company has been awarded contract for lighting the Capitol.

CLEVELAND, TENN.—The Water and Electric Light Company refused offer of the city to buy the plant for $35,000, but offered to sell the plant for $45,000 and all rents up to date.

WOONSOCKET, R. I.—The contract for the building of the Woonsocket Electric Machine and Power Company's new building on Main street was let to Joseph Gilman & Company.

HONEY GROVE, TEX.—H. H. Smith, Mayor, may be addressed for information concerning the construction of an electric light plant.

New Manufacturing Companies.

CHICAGO, ILL.—Illinois Chandelier Company has been incorporated by Gerhard Schwarting, Frank Hess and William A. Doyle, to manufacture electric fixtures. Capital stock, $2,500.

NEW YORK, N. Y.—The American Developing Company has been incorporated to manufacture engines and machinery for generating heat, light and power, and to manufacture and sell prepared or artificial fuel; capital, $1,000,000; directors, Robert Weld and Arnold R. Weber, of New York city; Richard H. Coe, William H. Abbott and Walter D. Shaw, of Boston.

UTICA, N. Y.—The Bossert Electric Construction Company has been incorporated. The company will manufacture and sell junction fuses and switch boxes, tablet boards, electrical switches and other electrical appliances. The capital stock is $16,000; principal office, Utica, N. Y.; directors, William F. Bossert, Henry P. Crouse, Seth C. Adams and Frank Sang, Utica.

BRUNSWICK, ME.—A corporation has been formed at this place, called the Snow Signal Company, to manufacture, buy and sell mechanical, mining, scientific apparatus, relating to signals, and to construct, lease and operate works to supply steam, heat and electricity. The capital is $50,000. The stockholders are F. C. Whitehouse, F. H. Purinton, Eugene Thomas, of Topsham, Gilbert Maxwell, Richmond, and Fred P. Snow, of Lynn, Mass.

PORTLAND, ME.—The Electric Spinning Mule Company has been organized at this place for the purpose of carrying on the business of manufacturing and general business in machinery for spinning, weaving and carding and the electric spinning mule, with $500,000 capital stock. The officers are: President, Edward K. Milliken, of Deering; treasurer, Lorenzo D. Hawkins, of Stoneham, Mass.

BUFFALO, N. Y.—The F. P. Jones Company has been incorporated to manufacture electrical apparatus; capital, $21,000; directors, F. P. Jones, Julius C. Sterns and Walter Cary, of Buffalo.

CLEVELAND, OHIO—Willard Electric and Battery Company has been incorporated. Capital stock, $20,000.

New Telephone and Telegraph Companies.

PATERSON, N. J.—The Passaic & Bergen Mutual Telephone Company has been incorporated. The authorized capital stock is $150,000. The stockholders are F. C. Van Dyk, James Simpson, James A. Morrisse, William B. Gourley, L. A. Piaget, A. A. Van Hovenberg, James F. Stewart, C. F. Van Riper, Ezra M. Stiles, Nathan Fleischer, William High, Andrew F. McBride, W. M. Smith, Leopold Meyer, W. Jay Holmes and George C. Mason, Paterson; Charles Kinkel, New York; Charles A. De Arnaud, Carlton Hill; George E. Travis, Brooklyn; Walter Kipp and J. J. Bowes, Passaic; Alexander B. Halliday, New York, and Charles Curie, Brooklyn.

MASSILLON, OHIO—The Central Union Telephone Company will spend $3,000,000 to make extensive improvements in its lines and in its service.

SMYRNA, DEL.—The Dover Telephone Company has been granted permission to extend its system to this place, and the addition will be in working order within a month.

MANKATO, MINN.—A franchise has been granted to the North Central Telephone Company and Blue Earth Valley Telephone Company.

BUFFALO, N. Y.—The Buffalo Valley Telephone Company has been building a new branch line to Jamison Road, which is nearly completed. The head office of the company is in this place and all the principal surrounding villages are connected by 'phone.

RUTLAND, VT.—The New England Telephone Company will begin immediately the construction of an iron metallic line between this place and Ludlow. The company will also string a line to North Wallingford.

GREENVILLE, MISS.—The Mutual Telephone Company has been incorporated by Lamar Watson, L. J. Mittinger and J. M. Jayne, to construct telephone system. Capital stock, $5,000.

MOLINE, ILL.—The Iowa Telephone Company has been incorporated by George W. Cable, A. F. Cutter, Joe R. Lane, A. Burdick and E. S. Carl. Capital stock, $1,000,000.

LEXINGTON, MO.—The telephone line is to be extended to Mayview, Odessa and Higginsville.

Increase of Capital.

TOLEDO, OHIO—The Toledo Consolidated Electric Company has increased its capital stock from $100,000 to $1,000,000.

CHICAGO, ILL.—The Evanston Electric Railway Company certified to the increase of its capital stock from $200,000 to $1,000,000.

HOOSICK, N. Y.—The Hoosick Railway Company stockholders have voted to increase the capital stock from $60,000 to $75,000, to be used in the construction of an extension from the terminus at Walloomsac to the Vermont State line.

NEW YORK, N. Y.—The Metropolitan Street Railway Company has increased its capital from $16,500,000 to $30,000,000.

The Bernstein Electric Company, Boston, are well settled in their new building and have a material increase in the matter of floor space and facilities for the production of their excellent incandescent lamps.

W. S. Hill & Company, since their reorganization, have put their plant at New Bedford, Mass., thoroughly in readiness for business and are maintaining a branch office at 57 Devonshire street, Boston.

The Western Telephone Construction Company, of Chicago, have contracted to furnish telephone systems for Sandersville, Ga., Maysville, Ky., Cobleskill, N. Y., Hot Springs, S. D., Cape May, N. J., Auburn, Ind., La Crosse, Wis., and have practically arranged for exchanges at Minneapolis and St. Paul.

The Electric Appliance Company, of Chicago, have made special arrangements for the manufacture of cross-arms for telephone work; *i.e.*, an arm two and three-fourths by three and three-fourths, with holes for one and one-fourth inch pins. On these goods the Appliance company are prepared to make specially low prices and prompt shipments.

For the accommodation of their city trade, the immense factories of the Washburn & Moen Manufacturing Company, at Worcester, seem to be in a most active condition. A representative of the ELECTRICAL REVIEW was granted a look at the department from which came the product of wires and cables for the electrical field, and was impressed by the very high standard which this company are able to maintain in view of the general tendency in this line of manufacturing.

A New Line of Engines.

The American Engine Company, at Bound Brook, N. J., have practically perfected a new line of engines which will be known as the American-Ball, and will embody the most advanced ideas of the well known expert, Frank H. Ball. Some of the interesting features of these are the automatic circulation of oil through all bearings and eliminating the splashing of oil either on the inner or outer side, a scientific method of counterbalancing, adjustable to conditions of foundation; new governor with last refinement of performance.

The company will build also a complete line of multipolar dynamos and motors, giving special attention to the best methods in direct-connected work.

MAGNIFICENT CENTRAL ISLIP, one of the most delightful places on Long Island; cool breezes and salubrious air. Houses in demand. Commutation tickets, 16c. a trip. $10 invested will bring you $50 in three months. Taxes only 50c. per lot per year. Every lot high and dry; no malaria; no swamp; a perfect sanatorium. Pure water, bracing air. The climate is softer and milder than New York or Brooklyn—something like Florida, salubrious and uniform. No auction sales, no bands of music, no free lunches to sell these lots. Will build cottages and advance four-fifths of the cost. Lots from $35 to $100; $10 cash and $5 per month. No interest charged.

AGENTS WANTED.

Central Islip Improvement Co,
17 & 19 Broadway, New York City.

BELLS, Push Buttons, Desk Clamps, Etc.
Send for catalogue; free if ELECTRICAL REVIEW is mentioned.
HUEBEL & MANGER,
Manufacturers,
286-90 GRAHAM ST.,
BROOKLYN, N. Y.

FOR SALE CHEAP.

20-K. W. 110-Volt DYNAMO, good as new, and in perfect order.
Address
J. P. WILLIAMS,
39 Cortlandt Street,
NEW YORK.

AN ENGINEER having references and very high connections, will accept
AGENCIES IN PARIS.
Address BOLIGE,
29 Passage Opera,
PARIS, FRANCE.

WHITNEY ELECTRICAL INSTRUMENT CO., MANUFACTURERS OF
High-Grade Electrical Instruments of Every Description.
PENACOOK, N. H., U. S. A.

McINTIRE'S PATENT
CONNECTORS AND TERMINALS.
Special Connectors for HARD-DRAWN COPPER WIRE, *All Sizes.*
Fused Wire, Fused Links and Strips.
The C. McINTIRE CO., 13 & 15 Franklin Street,
NEWARK, N. J.

WHITE-CROSBY COMPANY.
CONTRACTING ENGINEERS,
EQUITABLE BUILDING, BALTIMORE, MD
New York Office, 29 Broadway.

I-T-E
Automatic Magnetic Circuit Breakers
C-S Flush Switches.
The Cutter Electrical & Mfg. Co.,
1112 Sansom St., Philadelphia.

ELECTRIC CONDENSERS.
WM. MARSHALL,
Manufacturer.
STANDARDS A SPECIALTY.
709 LEXINGTON AVENUE, NEW YORK.

HOME STUDY.
An Elementary Journal
FOR TECHNICAL STUDENTS,
Including All Readers of Technical Books and Periodicals.
MECHANICAL AND ARCHITECTURAL DRAWING EXERCISES.
Home Study makes a specialty of teaching its readers how to make and read Mechanical and Architectural Drawings. Sample Copy sent free on application. Address,
B 1008. HOME STUDY, Scranton, Pa.

AMERICAN ARC DYNAMOS, LAMPS AND APPLIANCES.
Our new method armatures increase efficiency 20 per cent.
BAECHTOLD & PARKER ELECTRIC CO.
79-81 Washington Street,
BROOKLYN, N. Y.

Catalogue free if ELECTRICAL REVIEW is mentioned

No. 7707

IRON BOX BELL

Ask your dealer for the No. 7707 Iron Box Bell.

H. E. & C. BAXTER,
Manufacturers of
Electrical Supplies,
Bedford, Division and Canton Sts.,
BROOKLYN, N. Y.

Edison Fluoroscopes and Fluorescent Screens.

TUNGSTATE OF CALCIUM
prepared for use in fluorescing screens.

FINISHED FLUOROSCOPES
made up of any sizes, and according to most approved methods.

PHOTOGRAPHIC SCREENS
for use in making permanent shadow pictures, increasing the activity of the rays 50 times.

MANUFACTURED BY
AYLSWORTH & JACKSON,
Chemical and Electrical Technicists,
MANUFACTURERS OF
Incandescent Lamp Filaments and Carbon Specialties,
ORANGE, N. J.

Our FLUOROSCOPES are tasteful in design; they are provided with flexible and close-fitting eye-pieces, which make it possible to use them in a lighted room, and are as light in weight as is consistent with the strength of frame necessary to protect the screen. The screen is the result of careful experimenting with crystals of different sizes and applied in varying quantities. The method of supporting the crystals has received special attention; after thorough tests of paper of different kinds, cardboards, woven cloths, aluminum foil, etc., as mounts for the crystals, we have adopted that which proved best for the purpose.

ELECTRICAL PATENTS

ISSUED JUNE 30, 1896.

562,796 Electric railway; H. Brandenburg, Chicago Ill.—Consists of a conduit having inwardly projecting trolley rails or guides and the conductor above the same, the trolley having the contact for co-operation with the conductor and the insulated wear plates resting on the rails or guides.

562 806 Conduit for electrical conductors; J. F. Cummings, Detroit, Mich.—Consists of an outer metallic tube, an inner lining fitted on to the inner walls of the tube and comprising like sections having interlocking meeting edges and an elastic compound between the interlocking edges.

562 807 Telephone attachment; W. W. Dale, Fostoria, Ohio.

562,808 Means for protecting underground electrical conductors; F. Davis, London, England.

562,850 Electric gas lighting apparatus; F. O. Plummer, Worcester, Mass.

562,864 Dynamo electric machine; N. W. Storer, Wilkinsburg, Pa.—A generator having field magnet pole pieces, the tips of which are provided with slots or grooves extending transversely to the armature axis.

562 868 Dynamo electric machine; C. C. Warren, Chicago, Ill.

562,890 Electric railway; Bruce Ford, John town, Pa.

562,891 Electric hand-lighting gas burner; G. J. Galbraith, Boston, Mass.—Consists of a plate having an arm, a spring and pin, a toothed edge cam, upon the edge of which the pin is moved vertically and means for vibrating the same.

562,894 Electric railway; W. E. Handsgue, Kalamazoo, Mich.—A double electric conduit with a portion projecting up between the two, and an insulating material, extending around the interior portion of said conduit continuously up over the portion *n*.

562,906 Signaling apparatus for telephone lines; F. R. McBerty, Downer's Grove, Ill.—A telephone line having a switch in the line at the substation and a signal lamp and a source of current at a central station, a subsidiary bridge or branch of the line adapted to form a local circuit for the lamp and source of current, and a relay connected with the line controlling the said bridge.

562,917 Thermostat; C. B. Rogers, Stevenson, Md.

562,924 System of electrical distribution; G. J. Scott, Philadelphia, Pa.

562,925 Automatic speed controller for electric cars; H. A. Seymour, Washington, D. C.—An electric motor and its casing, a speed governor and set of resistances mounted in or upon said motor casing, and brake mechanism having its brake magnet in circuit with said resistance.

562,929 Electric signal; C. H. Sherwood, Utica, N. Y.

562,937 Electric hand lighting gas burner; H. C. Thomson, Boston, Mass.

ROSE POLYTECHNIC INSTITUTE,
Terre Haute, Ind. A School of Engineering. Mechanical, Electrical, Civil Engineering, Chemical courses. Well endowed. Extensive Shops and Foundry. Modernly equipped Laboratories in all departments. Expenses low. Address C.L. MEES, President

ELECTRICAL AND OTHER ENGINEERING BRANCHES
TAUGHT BY MAIL.
The Correspondence School of Technology,
CLEVELAND, OHIO.

NEW YORK ELECTRICAL REPAIR SHOPS,
A. K. Warren & Co.
(A. K Warren & J. R. Steers, Proprietors),
465 GREENWICH STREET, NEW YORK.
Repairs to
Armatures, Commutators, Motors and Dynamos.
Engine Room and Electrical Supplies.
Telephone, 881 Franklin.

Consolidated Telegraph & News Co.
53-57 Park Place, NEW YORK,
Contractors for and Manufacturers of ELECTRO-MECHANICAL APPARATUS.
ESTIMATES GIVEN ON ALL KINDS OF FINE SHOP WORK.
ELECTRICAL INVENTIONS DEVELOPED.

WANTED—By a man with 10 years experience in the practical operation of electric light plants and their construction, a position as superintendent of a central station. Best of reference and moderate salary. Understands armature winding, also engine repair and all work about plant. Has also been superintendent of waterworks and can handle and keep in order pumps. Not afraid of work. Address Multiple, care ELECTRICAL REVIEW.

FOR SALE
Three new Hoppes Purifiers, 300 H.-P. each, 38 inches diameter, 27 feet 5 inches long. Overheads made of 7/16" steel plate, double riveted on side seams. Dished steel plate heads 5/8" thick. Passed Philadelphia Boiler inspection at 129 pounds safe steam pressure.
Address
THE EDISON ELECTRIC LIGHT CO.
OF PHILADELPHIA,
10th and Sansom Streets,
PHILADELPHIA.

Summer Vacation Tours.

The Baltimore & Ohio R. R. Co. now has on sale at all its offices East of the Ohio River a full line of tourist excursion tickets to all the lake, mountain and sea shore resorts in the Eastern and Northern States and in Canada. These tickets are valid for return journey until October 31st. Before deciding upon your Summer outing it would be well to consult the B. & O. Book of "Routes and Rates for Summer Tours." All B. & O. Ticket Agents at principal points have them, or they will be sent upon receipt of 10 cents, for postage, by Chas. O. Scull, Gen'l Passenger Agent, B. & O. R. R., Baltimore, Md.

Geo. S. Chase. J. M. Vale.
CHASE & VALE,
Attorneys and Counsellors at Law,
(Patents and Trade Marks.)
Atlantic Building,
SPECIAL ATTENTION TO THE CLASSES OF ELECTRICITY, ELECTRIC LIGHTING, SIGNALING AND POWER.
WASHINGTON, D. C.
Telephone, 1288.

DYER & DRISCOLL,
Patent Solicitors, 36 Wall Street, N. Y.
have done all my patent soliciting work, both for this and foreign countries, continuously for the past fourteen years.
Thomas A. Edison

WASHINGTON PATENT AGENCY. LARGEST IN THE WORLD.
908-914 G Street, N. W.,
WASHINGTON, D. C.
Free opinion of merit. ELECTRICAL EXPERTS.

PATENTS.
TRADE MARKS.—DESIGNS.—COPYRIGHTS.
CAN YOU OBTAIN A PATENT?
Send me a model or drawing of your invention, and a description, and I will examine same and advise you promptly. My fees are moderate in all Patent matters, and I can obtain a Patent in the shortest possible time.
All Patents taken out through me are given special notice in the leading journals of the country, thus bringing same widely before the public without cost to inventor.
REFERENCES: "Electrical Review," New York; Paul Cromlein, Teller Lincoln National Bank, Washington, D. C.; Judge Geo. D. Parker, Berkley, Va.; Second National Bank, Washington, D. C.; E. K. Leech, U. S. Mint, Philadelphia, Pa.; W. P. Newell, Manager and Secretary Water Works, Olympia, Oregon.
EDW. S. DUVALL, JR., Loan and Trust Bldg.,
Solicitor of Patents. WASHINGTON, D. C.

OVER
100 PROJECTORS
INSTALLED THIS SEASON, SUBJECT TO GIVING ENTIRE SATISFACTION. ALL HAVE BEEN
ACCEPTED.
NOW USED BY THE U. S. AND FOREIGN GOVERNMENTS, OCEAN, LAKE AND RIVER STEAMERS.
LOOK FOR OUR 100 MILLION CANDLE-POWER LIGHT ON SIEGEL-COOPER BUILDING, NEW YORK.
SEND FOR CATALOGUE.
RUSHMORE DYNAMO WORKS,
JERSEY CITY, N. J.

PILOT HOUSE PROJECTOR, PATENTED.

IF you are interested in Underground, Aerial or Submarine WIRES or CABLES for Electric Railways, Electric Light and Power, Telegraph, Telephone, Signal Service, or for any other service,
WRITE
STANDARD UNDERGROUND CABLE COMPANY,
PITTSBURG, NEW YORK, CHICAGO.

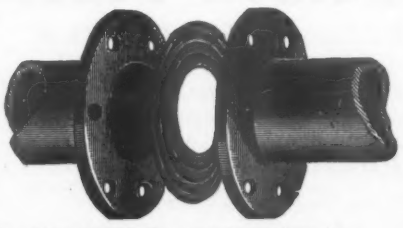
ALFRED F. MOORE,
MANUFACTURER OF
INSULATED ELECTRIC WIRE
FLEXIBLE CORDS AND CABLES,
200 and 202 North Third Street, PHILADELPHIA, PA.

FORT WAYNE ELECTRIC CORPORATION
FORT WAYNE, IND.
APPARATUS FOR
ARC, DIRECT CURRENT AND ALTERNATING INCANDESCENT LIGHTING AND POWER TRANSMISSION.

SOLAR CARBON & MANUFACTURING CO.,
MANUFACTURERS OF
Electric Light Carbons—Soft-Cored and Solid Carbon Brushes. Battery Carbons and Carbon Specialties.
ADDRESS 95 FIFTH AVENUE, PITTSBURGH, PA.

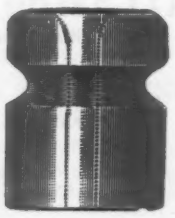
BAKER & CO.,
IMPORTERS, MELTERS AND REFINERS OF
PLATINUM,
408, 410, 412 and 414 N. J. R. R. Ave., NEWARK, N. J.
Platinum in sheet and wire, all sizes, and any degree of hardness. Scrap and native Platinum purchased
NEW YORK OFFICE: 121 LIBERTY STREET.

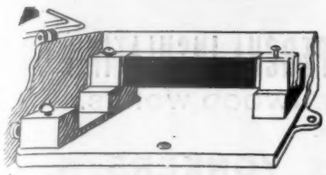
Joints made absolutely tight and durable by PATENT CORRUGATED
COPPER GASKETS.
Furnished in all shapes and sizes for flanged PIPES, CYLINDERS, CHESTS, Etc. Price-List and Sample free.
U. S. MINERAL WOOL CO.,
2 Cortlandt Street, NEW YORK.



Bourne & Knowles Mfg. Co., Cleveland, O., Western Agents.

PORCELAIN MANUFACTORY.
Empire Comb Works.
144-166 GREENE ST STATION C
BROOKLYN, N.Y.
GENUINE HARD PORCELAIN, CUT-OUTS, SWITCH BASES, INSULATORS &c





IRONCLAD FUSE BOX.
ARC-KNIFE SWITCH
MAST-ARMS.
Write Us. Get Our Discounts.
Utica Electrical Manufacturing and Supply Co., UTICA, N.Y.

THE GARVIN MACHINE CO.,
MAKERS OF AND DEALERS IN
METAL-WORKING MACHINERY
OF EVERY KIND.
Universal and Plain Milling Machines, Drill Presses, Screw Machines, Hand and Engine Lathes, Planers, Turret Lathes, Shapers, Gear Cutters, Die and Cutter Grinders, Tapping Machines, etc., etc.
A COMPLETE LINE OF
Special Bicycle Machinery.
Write for catalogues and list of new and second-hand machinery for immediate delivery.
SCREW SLOTTING MACHINE
SPRING & VARICK STS., NEW YORK.
51 NORTH 7TH ST., PHILADELPHIA, PA.

TESLA HIGH-FREQUENCY COILS FOR X-RAY WORK

THE ONLY APPARATUS ON THE MARKET THAT WORKS UNDER ALL CONDITIONS. SHOWS THE ACTION OF THE HEART.

MANY LEADING HOSPITALS ALREADY EQUIPPED; OTHERS BEING SUPPLIED AS FAST AS THE INSTRUMENTS CAN BE MADE.

SEND FOR CATALOGUE.

L. E. KNOTT APPARATUS CO., 14 Ashburton Place, BOSTON, MASS.
Chemical, Microscopic and Physical Apparatus.

THE ONLY WATER-WHEEL GOVERNOR THAT GOVERNS.

WATERVILLE AND FAIRFIELD RAILWAY AND LIGHT CO.,
WATERVILLE, ME., January 18th, 1896.

LOMBARD WATER-WHEEL GOVERNOR CO.,
BOSTON, MASS.,

Gentlemen: In regard to your Type C Governor, which is regulating for us our two Hercules Wheels, which give power to operate our light plant, street railroad and power generator, we are frank to admit that THE MACHINE DOES ITS WORK ADMIRABLY. We have no hesitancy in recommending it to those in want of a Governor.

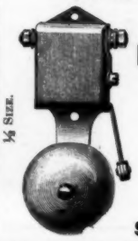
Yours truly,
(Signed) I. C. LIBBY,
President Waterville and Fairfield Railroad and Light Co.

LOMBARD WATER-WHEEL GOVERNOR CO., 61 HAMPSHIRE ST., BOSTON, MASS.

HOW TO WIRE BUILDINGS

The Book for Wiremen, Electrical Engineers, Contractors, Constructing Engineers, Architects and Students. 162 Pages. Illustrated. Price, $1.50. Sent to any address on receipt of price.
Electrical Review Pub. Co., 41 Park Row, New York.

Wanted, Electric Bells.



½ SIZE.

MAKERS of this kind of Electric Bells please send address and price to:

"EUROPEAN HOUSE"
SV. TELEGRAMBYRANS ANNONSAFDELNING,
STOCKHOLM, SWEDEN.

The New Diehl Electric Fans | SEASON 1896.

Highly finished in Japan,
Nickel,
Polished Brass and
Venetian Designs.

Increased Efficiency,
Improved Mechanical Construction.

Show Rooms,
561 Broadway, New York City.
128 Essex Street, Boston.

For catalogues and price lists, address
DIEHL MANUFACTURING COMPANY, ELIZABETHPORT, N. J.

HABIRSHAW WIRES AND CABLES

have been, are now,
and always will be

THE BEST.

THE
INDIA RUBBER & GUTTA PERCHA INSULATING CO.,
MAIN OFFICE, GLENWOOD WORKS,

J. W. GODFREY, Manager Sales,
15 Cortlandt St., NEW YORK.

YONKERS, N. Y.

Received the Only Medals of Award for Rubber-Covered

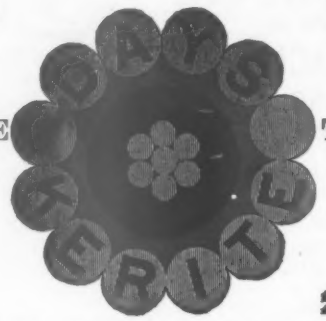
INSULATED WIRES

AERIAL, UNDERGROUND, SUBMARINE AND INTERIOR USE.

KERITE TAPE.

Catalogues, Samples and Prices on Application.

S. F. B. MORSE, CHICAGO, ILL.
CALIFORNIA ELECTRIC WORKS, SAN FRANCISCO, CAL.
KENNEDY & DU PEROW, WASHINGTON, D. C.



Wires and Cables at the WORLD'S FAIR at Chicago.

AND CABLES;

TELEPHONE, TELEGRAPH, POWER AND LIGHTING.

W. R. BRIXEY, Manufacturer,

J. E. HAM, General Agent,
203 Broadway, NEW YORK.

SPECIAL ATTENTION GIVEN LEAD-ENCASING WIRES AND CABLES.

WESTON Electrical Instrument Co.,

114-120 William St., NEWARK, N. J., U. S. A.

Illuminated Dial Station Instruments.

These instruments are based upon the same general principle, and are just as accurate as our regular Standard Portable Direct-Current Voltmeters and Ammeters, but are much larger, and the working parts are inclosed in a neatly designed, dust-proof, cast-iron case which effectively shields the instruments from disturbing influences of external magnetic fields.

Weston Standard Illuminated Dial Station Voltmeter, Style B.

Weston Standard

Portable Direct-Reading Voltmeters and Millivoltmeters, Ammeters and Milliammeters, Wattmeters and Voltmeters for Alternating and Direct-Current Circuits.

Our portable instruments are recognized as standards throughout the civilized world.

Our **Semi-Portable Laboratory Standard** Voltmeters and Ammeters are still better.

They are the most reliable, absolute standards for Laboratory use.

Mention the ELECTRICAL REVIEW when writing for catalogues.

WEATHERPROOF WIRE

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

MANUFACTURED BY

PHILLIPS INSULATED WIRE CO.

New York Office, 39 & 41 CORTLANDT ST.
Factory, PAWTUCKET, R. I.

AGENCIES:

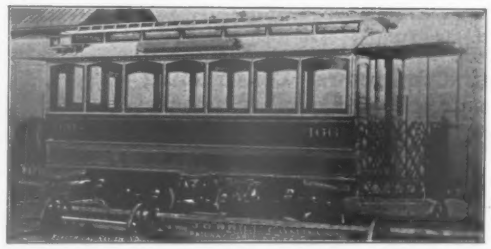
Pettingell-Andrews Co., Boston, Mass.
Electric Appliance Co., Chicago, Ill.
Electrical Engineering Co., Minneapolis, Minn.
St. Louis Elec. Supply Co., St. Louis, Mo.
Bradford Belting Co., Cincinnati, Ohio.

J. G. BRILL COMPANY,

Philadelphia,

BUILDERS OF

ELECTRIC, CABLE, SUBURBAN CARS AND TRUCKS.



INVENTORS and BUILDERS OF
BRILL No. 21 B and
EUREKA MAXIMUM TRACTION TRUCKS
FOR
ELECTRIC CARS.

To the Electrical Trade of

MICHIGAN, OHIO and INDIANA.

We carry the largest and most complete stock of Electrical Supplies in this section of the country, and our prices will compare favorably with the best.

Write for quotations on anything you may need, or send us a trial order.

MICHIGAN ELECTRIC CO.,

DETROIT, MICH.

MICHIGAN AGENTS GENERAL ELECTRIC COMPANY.